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THE AUTHOR, to prevent fraud, offers a reward of One Hundred Pounds to any one who will give information against any person or persons who will attempt to print or publish this work without his approbation, under his hand and seal in writing first obtained, agreeable to the Act of Parliament in that case made and provided. Also, a further reward of Fifty Pounds to any person who has taken out of this work the number of pages specified in the said Act. And a further reward of Thirty Pounds will be given to any person who will give such private information as may lead to the discovery of the offender, and his name shall be kept private.

D. O'GORMAN.

MANCHESTER, MAY, 1858.

ENTERED AT STATIONERS' HALL.

THE

QUEEN'S APPROBATION AND PATRONAGE OF THE WORK.

On receipt of a copy of the book, Her Majesty was pleased to make the following gracious reply:—

"Buckingham Palace.

"Miss Skerritt begs to inform Mr. O'Gorman that Her Majesty received the Arithmetic Book which he sent. H. M. thinks it is a book likely to be of great service in teaching ready calculations.

"Her Majesty was graciously pleased to accept of the copy.

"Mr. D. O'Gorman."

TESTIMONIALS OF THE PRESS.

Amiable Conduct of Her Majesty to a Resident of this City.—"Her Majesty has been pleased to receive the book, and has in the most handsome manner expressed her high opinion of the merits of the work: such a criticism from the most illustrious personage in the realm must go far to render the book universally sought after, and a seventh edition is already, we understand, in the press."—*Durham Chronicle.*

"Mr. O'Gorman published lately a new Intuitive Arithmetic, a copy of which, richly bound in morocco, he sent as a New Year's offering to the young Prince of Wales, through Her Majesty. On the 8th inst. the author received a reply, acknowledging the receipt and acceptance of the present, accompanied by a flattering notice of the merits of the book."—*Newcastle Journal.*

"Some short time ago, Mr. O'Gorman published an Arithmetic, showing a simple and ready mode of performing various calculations. The author sent a copy of his new work as a New Year's present to the young Prince of Wales. About a month ago, Mr. O'Gorman received an acknowledgment from Her Majesty, which, perhaps, is the first instance on record of a testimonial being given by the most illustrious personage of the realm on the merits of a book."—*Sunderland Herald.*

"We can recommend this work as containing several very useful rules, which very considerably shorten the calculations which every one is obliged to make in transacting the ordinary business of life. *The plan of the treatise is both new and ingenious;* and it is free from the common fault of 'tedious methods,' a tendency to give merely a superficial acquaintance with the subject treated of."—*Durham Advertiser.*

"This is one of the simplest and shortest systems of popular Arithmetic that we ever met with. To those who have the painful remembrance that we have of the labour which it costs boys to work the old rule of three problems, according to Gough or Cocker, this little volume will appear one of the *treasures of the rising generation.* Many of the rules for solving with certainty, and in an instant, the most complicated Arithmetical questions, are so simple, that a child may comprehend them. *The work is really a marvel of ingenuity.*"—*Hull Advertiser.*

"We would direct attention to the announcement of O'Gorman's Intuitive Arithmetic. The high approvals which it has met with in the most distinguished quarters, stamp it as a work of great utility."—*Hull Packet.*

INTUITIVE CALCULATIONS.—"Mr. O'Gorman has just published a work under this title, which appears to be well worthy of attention. Its object, as its name implies, is to enable the pupil to solve arithmetical questions by an almost instantaneous mental process. The rules appear to be extremely simple, and much greater certainty of accuracy is, we understand, insured than by the common methods. The book, we see, has been brought under the notice of the Queen, and has been honoured by Her Majesty's approbation."—*Berwick Advertiser.*

"We direct attention to Mr. O'Gorman's advertisement. We have been enabled to make only the most cursory examination of his little book; but he seems to us to have greatly simplified and facilitated the difficult, but very useful science of Arithmetic; and the high testimonials he has appended in its favour, appear to justify us in the opinion we have formed." —*Kendal Mercury.*

INTUITIVE CALCULATIONS.—"This is the most concise course ever published. We some time ago possessed ourselves of a copy of this work, an improved edition of which the author, we believe, is about to issue. Its contents fully justify its title. It is calculated to be of great service to men of business, and, indeed, to all classes. It is a striking

example of labour and ingenuity on the part of its author. Mr. O'Gorman, we think, will find commercial purposes aided by having the name of a London publisher, as well as a country one, on his next edition."—*Stockton Times.*

INTUITIVE CALCULATIONS.—"We have pleasure in drawing attention to Mr. O'Gorman's improved method of acquiring a knowledge of Arithmetic. To all persons engaged in business, a perusal of this treatise would greatly facilitate the transactions of accounts, and to young persons it may be recommended as a useful guide to a most essential branch of education."—*Preston Guardian.*

INTUITIVE CALCULATIONS.—"Mr. O'Gorman has just published a small volume under the above title, which strikes us as being one of the best instructors on the subject we have ever seen. For those who wish to learn the shortest and most rapid mode of calculating numbers, from the simplest to the most complicated, we could not recommend a better book."—*Carlisle Journal.*

"We have pleasure in directing the reader's attention to Mr. Daniel O'Gorman's advertisement of, what he terms, 'Intuitive Calculations.' The simple rules are laid down in a different and, in our opinion, easier manner than those found in other elementary works on the science of numbers, and therefore will be found highly useful, especially to persons in adult life, whose education may have been neglected. Junior pupils will find from the examples given of *Long Division*, that the quotient is shown in one line at the bottom, like *Short Division*, which is a great saving of time and labour."—*Whitehaven Herald.*

NEW CALCULATIONS.—"The attention of our readers is directed to the announcement of a new system of Intuitive Calculations, by Mr. O'Gorman, in our advertising columns, which has gained a favourable critique from Her Majesty and a great portion of the local press. The system would appear to be just that which every clever man of business has suggested to him in his experience, as distinguished from the round-about mode taught in the arithmetics in common use. The author, it will be seen, is also his own bookseller."—*Newcastle Journal.*

INTUITIVE CALCULATIONS.—"The treatise published under this title by Mr. O'Gorman is really what the advertisement in another page asserts it to be—the readiest and most concise method of short calculation ever published. The rules are short, yet perfectly explicit; and a reason being attached to each, a lasting impression is thus imparted to the youthful mind. The results, too, are given in a sixth part of the compass usually occupied by those in similar works. The system of Mr. O'Gorman is, therefore, not only novel but unique. In short, it may be denominated the *Royal Railroad* to Arithmetic, having obtained the patronage of Her Majesty the Queen to the work, as a 'book likely to be of great service in teaching ready calculation.'"—*Caledonian Mercury.*

IMPROVED ARITHMETIC.—"We direct attention to the announcement of O'Gorman's new and improved system of concise and ready calculation. We have been careful to give attention to the rules laid down, and the examples given after each rule, and from the manner in which the author has treated the science of numbers, we are not at all surprised at the

to them, still have they been for some time before a large portion of the public. Mr. O'Gorman being one of those who think that business is never as well performed by a deputy as it is by the principal himself in person, he has but recently visited Sheffield. 'Every author his own bookseller' is strikingly exemplified in the present case. As far as Mr. O'Gorman has published himself, the highest praise has been bestowed on the merits of his treatises: the arithmetic has already reached a sixth edition, and although late, still we are glad—even now—to add our testimony to the value of his labours."—*Sheffield Free Press.*

O'GORMAN'S NEW INTUITIVE CALCULATIONS, PATRONISED BY THE QUEEN.—"Many systems of arithmetic as we have seen, this surpasses all. O'Gorman seems to have arranged his book on the unerring principles of true philosophy, and therefore, so far, has followed the laws of nature. He seems to us to know the exact workings of men's minds, when engaged in calculation, and has arranged his rules accordingly. Nothing is more easy to the beginner than this system of arithmetic, than which, nothing has yet met our attention worthy to be compared with it. We shall highly prize it as a book for every day reference. If every school has not adopted it, the sooner it is called into requisition the better it will be for the rising generation."—*Lincolnshire Free Press.*

"We have seen the treatise on this subject advertised in another column, and found it to contain valuable methods of shortening the ordinary calculations of arithmetic, and greatly simplifying the rules. It also contains many very valuable tables, and altogether we consider it a work well deserving the attention of men of business, and of all who are engaged in the instruction of youth."—*Cardiff Salurian.*

"We have seen a system of arithmetic to which its author, Mr. O'Gorman, has given the above title. It has attained to a seventh edition, and is accompanied with a body of commendatory notices from competent judges, who have tested the value of the work. The system appears to us to possess the double merit of clearness and conciseness; and will, doubtless, greatly facilitate arithmetical operations."—*Swansea Herald.*

"We would direct the attention of our readers to an announcement in our advertising columns of the publication of O'Gorman's Intuitive Arithmetic. The flattering manner in which it has been spoken of in high quarters shows it to be a work of great merit; and from a cursory examination of it we are inclined to consider the rules simple, and well calculated to facilitate arithmetical operations of almost every kind."—*Gloucester Journal.*

"A system of arithmetic under the above title is now published, and has already reached its seventh edition. The system has been spoken of, by high and competent judges, as the best ever published—both for clearness and accuracy. The work is of the greatest value to all engaged in mercantile pursuits."—*Cambrian.*

"Being anxious at all times to forward works of a useful character, we have great pleasure in recommending to our readers O'Gorman's New Intuitive Arithmetic, advertised in another part of our paper, believing as we do, that the work is one of the most valuable acquisitions that has yet been produced in reference to the branch of education on which it treats. *Mr. O'Gorman has* succeeded in simplifying arithmetic, so as to render it

easy of acquisition by the humblest capacity, without the aid of a vocal teacher. Abreviating the process of education is one of the advantages which may be calculated upon in these days of improvement. There are few who have passed their pupilage who will not have felt they have been led through a long and intricate path. Their grammar and spelling-books were dry and tedious productions; so were their arithmetics. Each has undergone various simplifications, and the young student has had a view of the thorns cleared from his track which, however, in some important branches of education is yet beset with many difficulties. We are glad that another successful experiment has been made by the author of the above work, whose system has drawn forth the highest encomiums from preceptors of undoubted respectability. The work has passed through six editions, and about twelve thousand copies have already been circulated."—*Nottingham Review.*

"As far as a cursory glance at this work enables us to judge, it appears to be a great improvement on the arithmetics of our school-boy days, and very much to simplify the ordinary method of making calculations. The Intuitive Arithmetic has had a very extensive sale, and is strongly recommended by those better qualified than ourselves to pronounce an opinion on its merits."—*Bradford Observer.*

"Another edition of two thousand, being the fifth that has appeared! This, indeed, *is* success, such as few authors can boast of, and success too, all the more wonderful and creditable from the fact of so many books of the kind being in the market. But, O'Gorman's system must have something extraordinary to recommend it, for we find it adopted by the Normal and other leading schools in Scotland, as well as by many of the best educational establishments in England. Its main features seem to be simplicity and adaptation to popular wants, and these are the great wants of the day in teaching any science. In the new edition we observe various improvements and novel features, which will render the work increasingly useful. The author appears to have spared neither labour nor expense in rendering his book more complete than ever; and, judging from the continued demand for it in all parts of the country, he may be certain of even greater encouragement than he has yet met with."—*Guardian.*

"Mr. O'Gorman's work, advertised in to-day's paper, contains rules by which the methods adopted by expert calculators, so different from the ordinary school-mode of arriving at results, is reduced to a system. The work will be useful to hundreds of persons in this town."—*Sheffield Times.*

"We have received a copy of O'Gorman's New Intuitive Arithmetic, advertised in another column, the subject of which is to introduce more concise and easy methods of working arithmetical problems than those commonly taught in our schools. We have not yet had an opportunity of giving the work such an examination as would enable us to pronounce a decided opinion of our own respecting it; but from the high praise bestowed upon the book by the press generally, we are induced to believe that it is a work of considerable merit, and which may be studied with advantage by young men destined for trading pursuits."—*Leeds Times.*

"O'Gorman's System of Intuitive Calculations.—The short period previous to our going to press at which we received this work on arithmetic,

advertised in another column, has not enabled us to give it a very comprehensive perusal; but from the few examples we have studied, we have no hesitation in saying the system must prove of infinite advantage in rapid calculation, and an immense waste of time will be avoided. We observe testimonials of the press, from almost every part of the kingdom which Mr. O'Gorman has visited, of the highest order; and the fact of the work having attained a seventh edition of 13,000 copies, demonstrates that the praise bestowed upon it is not unmerited."—*The Welshman.*

RECOMMENDATORY LETTERS.

Manchester, 18th September, 1852.

SIR,—The Committee of the Manchester Free Library and Museum have received your book on "Intuitive Calculations," 12mo., and request me to return you their best acknowledgments and thanks.

I have the honour to be, Sir,
Your most obedient Servant,
JOHN POTTER,
Chairman.

Mr. D. O'Gorman,
98, Chester-street, Hulme.

I have carefully looked through Mr. O'Gorman's admirable little Treatise on Arithmetic. Its tables are of the most useful description. Its rules are given with clearness and precision, and constitute it the very best manual I have seen of rapid and expeditious calculations. Portions of it show that Mr. O'Gorman has sounded the depth of the profoundest parts of arithmetical science. I have been delighted with his book, and sincerely hope that its sale will be in direct proportion to its utility; and then, if the author be not remunerated sufficiently for the usefulness and clearness of his labours, there is no truth in the most golden rule of the important science, to the elucidation of which he has directed his talents.

CHARLES LARKIN, M.D.

Charlotte Square, Newcastle-upon-Tyne,
4th February, 1853.

Mr. Daniel O'Gorman.

Academical Institution, Blake Street, York.
8th January, 1853.

DEAR SIR,—In compliance with your request I forward my opinion of your new and comprehensive work on "Intuitive Calculations;" and, presuming that you intend to record my humble judgment, with that of others already printed in your fourth edition, you have every liberty to make use of this as you deem fit. The public expect candour from an old experienced teacher, and I shall be candid; therefore I have no hesitation in coming forward and expressing my warm approbation on the merits of your book. I consider it valuable, highly valuable, indeed, not only to the teacher, but to the merchant, the clerk, the counting-house, the counter, and the timber yard. You deal in general principles, which renders the work more valuable, *so far as mer*cantile transactions are to be brought into operation. The

brevity of your rules, the reasons so clearly given, and the simplicity of operation, render it a work within the reach almost of any capacity; and if teachers will take only a little trouble to impress the system on the minds of their pupils, it will be an incalculable benefit to the rising generation; and I have only to add, that I shall lose no time in introducing your system into my own establishment.

Pray send me twelve copies of the seventh edition as soon as you get it from press; and believe me, dear Sir, with every sentiment of respect, and a due regard for your labours and ingenuity,

Most faithfully yours,

Mr. Daniel O'Gorman. HUGH HARKIN.

Glasgow Athenæum, 15th March, 1853.

DEAR SIR,—I have carefully examined your work on concise calculation, and have no hesitation in bearing my humble testimony that it is incomparably the easiest understood, and by far the most complete of any work hitherto published on the subject. I am sure it only requires to be known to be placed in every office and counting house in the united kingdom, and also, as it is adapted for a *class book*, in every public and private school, while its simplicity renders it of incalculable value to the private student. In the hands of fathers and mothers their children can progress with ease and facility in the solution of numerical calculations, by its plain and easy guidance. I shall merely repeat that your little book is the most complete, important, easy, and useful work that has ever issued from the press on the subject of concise arithmetic.

Wishing you a long life to exercise your genius and talents for the benefit of mankind, I remain, dear Sir, faithfully yours,

JAMES McKENNA,

Vice-Chairman of the Board of Directors of the Glasgow Athenæum, and Agent of the United Kingdom Temperance and General Life Assurance Association.

D. O'Gorman, Esq.

SIR,—Having heard so much of your ingenious work on Intuitive Calculations, I was anxious to secure a copy of your second edition, which is now in my possession. I have no hesitation in pronouncing it the very best book on the subject that ever came before me. The originality of your rules, with the brevity in the operations, I cannot but give my warmest approbation to, and your ingenious method of long division, may be called the phenomenon of figures. Wishing you ample remuneration for your ingenuity, I am, respectfully, yours,

JOSEPH BATEMAN PHILOMATH.

SIR,—I have at your request examined your Treatise on Intuitive Calculations, and believe it to be highly deserving of public support. Notwithstanding the many books already extant on that subject, I am persuaded that the public are much in want of such a work as yours.

I am, Sir, with much esteem, your faithful friend,

Mr. Daniel O'Gorman. SAMUEL LAURIE.

SIR,—In compliance with your request I have read your new treatise on Intuitive Calculations. I think it to be of great service to the accountant, and will be found useful to the man of business, no matter in what department. It appears to me a work valuable to the counter, the counting-house, the merchant's office, or the timber yard; indeed, in my mind, no mercantile establishment should be without it. I do not know you personally, yet I have no hesitation in giving this my opinion of your meritorious labours.

I am, Sir, your obedient servant,

D. M'INTOSH,
General Accountant.

Academy, 2, Hedworth Terrace, Sunderland,
1st January, 1852.

DEAR SIR,—I have examined your Intuitive Arithmetic, and consider it well calculated to prepare youth for the engagements of business. Your rules are concise, and adapted to illustrate the multifarious application of figures, and must greatly conduce to the discipline and expansion of the youthful mind. Your exercises are in accordance with real business transactions, which is very important to the noviciate, and you have avoided all circuitous calculations, and have adopted easy methods which involve an originality (and in no case inapplicable) to which you, as an author, can with justice lay claim.

I am, dear Sir, yours very respectfully,

JOHN MARTINDALE,
Author on Agricultural Chemistry.

To Mr. D. O'Gorman.

I do confess that I took up Mr. O'Gorman's work on Intuitive Calculations with every degree of reluctance, expecting to meet nothing but the hackneyed rules of arithmetic, which have long since been worn threadbare. I have been agreeably disappointed. To much matter, and an entire new method, there is an arrangement remarkable for brevity and perspicuity. That the public may benefit from the book, and the author get his reward, is the sincere wish of

J. INGLEDEW.

To Mr. D. O'Gorman.

ADVICE TO YOUNG MEN

ENTERING INTO THE EMPLOYMENT OF OTHERS.

"Good rules acted upon are the sinews of character."

My dear Friends,—Read, mark, and digest the following lines: they were written for the benefit of young men, and it is hoped many will profit by them.

First.—Observe strict integrity in all your conduct. Never make a promise which you have not a reasonable prospect of fulfilling; and, when once made, use every exertion in your power to accomplish it. To be successful in the performance of your duties, *first learn to do everything well, then learn to do it in the least possible time;* by continued and persevering efforts, both will become easy and habitual to you, and the habits thus formed will be of incalculable benefit through life. Make it a matter of principle to discharge all the duties assigned you to the best of your ability; endeavour to do more than is expected of you, rather than less, for by so doing, you will not fail to acquire the confidence and respect of your employer. If you find that you cannot accomplish all that he may require of you, notify him thereof in season, that his expectations in regard to you may not be disappointed, nor his business unnecessarily retarded, and your own credit will thereby be saved.

Second.—As we become attached to those who take pleasure in our business, and in promoting our interest, it may be received as a maxim, that the more you are doing for your employer, the more you are doing for yourself, as by that means you are perfecting your own usefulness, and increasing his favourable opinion of you, to deserve which should be your constant aim, and which will in after life be to you a source of much credit and satisfaction, and often of very great advantage.

Third.—At all times show proper respect to your employers and superiors in station, and take pleasure in obliging them. Keep the secrets of your employers *inviolate*—relate none of his business to *his* or *your* most intimate friends; it would be manifest treason on your part to do so; besides, too, it is as much his property as the money in his drawer. Your time is the property of your employer; do not, therefore, absent yourself during the hours of business without his permission.

Fourth.—Never permit others to injure your employer, or abuse his confidence, without giving him notice, for your own character is concerned in it as well. When sent an errand, or requested to attend to any special duty, use *dispatch*, and make a report immediately on the performance thereof; as it frequently happens that matters of importance are connected therewith, which may require immediate attention.

Fifth.—Let the duties of each day be regularly performed, even if extraordinary effort be necessary. Do everything in its proper season, and postpone nothing which you can conveniently attend to. Undertake but *one* thing at a time, and pursue it, if possible, till accomplished. Let there be a distinct and separate place for everything, and keep everything in its place.

Sixth.—Keep an account of your expenses, and economise your money as well as your time: your future happiness and respectability will depend, in a great measure, on the proper use of both. The celebrated Duke de Sully, the great French statesman, ascribed his success in life to the strict economy observed in his youth. Should you meet with difficulty in the performance of your duties, do not be discouraged on that account, for you will overcome them all by perseverance. A sound and discriminating judgment is peculiarly necessary in buying and selling. As the skill of a physician consists in ascertaining the precise nature of a disorder from the symptoms it presents, and as this skill cannot be acquired without diligent and extensive observation, in like manner the cleverness of a tradesman chiefly consists in being able keenly and correctly to perceive the value of the article in which he traffics; nor can this acuteness be obtained without vigilant attention, or, in other words, without considerable mental exertion.

Seventh.—The careful observance of those rules will enable you to get through with your duties, not only to the satisfaction of your employer, but even to your own advantage; and if you are careful to observe them conscientiously in the several respects in which they are laid down, you may reasonably expect

the blessing of Providence will rest upon you, and you will not fail to reap your reward in due season.

Eight.—*To those young men who are entering as mechanics*, we would say, let it be your strong and abiding determination to become master of your art or calling, whatever it may be. Study it deeply, and in all its branches. Resolve to be ignorant of nothing that pertains to it. Strive to acquire dispatch with cleverness in performing all its duties, from the most trivial to the most momentous. This habit you will not fail to acquire, if you make it a rule to do everything in the best and quickest way you possibly can. Many a bungling, good-for-nothing workman has become such, not for want of capability, but for want of desire to excel, which has led him to contract the habit of doing everything in a careless, slovenly manner. Be not satisfied with learning your business by rote, and of attaining that manual dexterity which careful practice will ensure, but endeavour to form comprehensive views of the nature of your profession. Examine and become familiar with the scientific principles on which it is founded. This will teach you the best method of conducting the operative part of it; it will enable you to account for strange appearances, and to deal with new cases, which, if you are ignorant, would be inexplicable and embarrassing. And there is scarcely any department of manual occupation, however mean, which does not involve philosophical principles, the knowledge of which it is, therefore, the interest of all workmen to obtain.

THE AUTHOR.

Manchester, May, 1853.

ADVERTISEMENT.

THE extensive sale, and still pressing demand for the New Intuitive Calculations, obliges the author to meet the anxious wishes of the numerous public who have so liberally patronised him in the sale of the six former editions, and therefore he requires little apology in introducing a seventh.

To the present edition many useful rules are added, and new discoveries made in the application of figures, which the Philomath, the man of genius, and the mercantile man will find well calculated to assist him in transacting the ordinary business of the day, with accuracy and despatch, and in the tenth part of the time usually required, or laid down in the common school arithmetics, and all so plain and intelligible, that the plan of operation is brought under the comprehension of the weakest capacity, and if not convenient, the system can be acquired in ten or twelve weeks without the aid of a master. Neither pains nor expense has been spared in rendering the present edition of the greatest importance to the merchant, the mechanic, the accountant, the schoolmaster, and the tyro, who wish to become smart and ready calculators, no matter how difficult the transaction, and all with such facility and precision as to ensure a correct result. All that is required is a perfect knowledge of the tables to put the plan in operation; and should an error be committed, the figures required are so few, that it will at once be discovered, and an easy correction made without poring over a side of figures, usual in the ordinary method of calculation.

It is acknowledged by all, that young men after six or seven, nay, some ten years studying arithmetic at school, and then entering into business, must throw the old school course overboard, and take the readiest method that ingenuity can devise for totting their accounts. This is no invention; it is the honest acknowledgment of all men of business with whom the author has conversed on the subject. Such is the fact, and to remedy this want, and to give a proper system of concise calculation

to the public, was the great object and aim of the author, and it is now gratifying to him, to have such a list of subscribers to bear testimony to the usefulness of his labours.

To the nobility, gentry, professors, teachers, merchants, and traders, he tenders his warmest thanks and acknowledgments for their liberal support; and the sincere wish of his heart is that each and every one into whose hands the present edition may fall, may reap the benefit intended by the author.

As the tables are of the greatest importance, and in fact may be called the key to the various rules, we would beg the most serious attention of our young friends to study them with accuracy, and not only that, but to commit them to memory, and to observe the general rule laid down by a judicious author, "that anything well known should not be too long dwelt upon, or nothing imperfectly known passed over." After the simple and compound rules, with their variations, are well understood, the calculations after become simple, and all mercantile transactions rendered familiar, the principle being based on the currency of the country, that is 12 and 240; 12 pence being a shilling, and 240 pence a pound; these two numbers are of course applied in all cases, 12 being brought up to 240 by an equation with the smallest fraction, and 240 to infinity in a similar manner. So that a perfect knowledge of the money tables, together with these new composite tables of 12 and 240 with fractions, are also essentially necessary.

In conclusion, the author submits the present edition, confident of a renewal of that liberal support which he has hitherto received from an enlightened public.

D. O'GORMAN,

MANCHESTER, MAY, 1853.

INTRODUCTION.

As the common Arithmetics of the day contain much matter with which there is no absolute necessity that every pupil should make himself acquainted, and as these books generally fall into the hands of those who have neither time to waste nor opportunity to avail themselves, this work indiscriminately, is intended to assist the young student in the groundwork of ready and useful calculations, as well as the practice. We have therefore carefully studied what course should be laid down in a matter of such importance, and we trust the rules and examples will be found to suit the object, viz.,—the rapid improvement and easy access of the pupil to ready calculation, and our own character depending thereon. We trust that in the following treatise such a system of science and practice shall be found, that our subscribers and readers never met with anything more suitable to their avocations and wants. We purpose in the following sheets to lay down such rules, principles, and short methods, that every schoolboy, and those of the most dull apprehensions, shall receive such benefit and instruction, as no other work on the subject can afford. After our young friend has made himself master of numeration and its dependent principles, we then recommend to his most serious perusal, the definitions and tables in the first part of the work; these, if properly attended to, will serve him in the whole course of his studies: many excellent accountants have been wandering in the dark, merely through want of such assistance. If the pupil's time and genius afford the opportunity of committing to memory our demonstrations, so much the more will he profit; but if these favourable circumstances occur not, then let him carefully attend to the tables; and we *assert, r*oundly, so complete a set of tables, coins, weights, and

measures, were never before published. A perfect knowledge of these tables will serve every student, be his intended profession what it may. In the whole, the system will be found of the greatest importance, and the pupil, therefore, according to his ability and taste should attend to it closely, and make it his study never to pass over any rule without knowing its meaning, nor dwell too long on any case perfectly understood.

Surely, short and easy methods in accounts give the pre-eminence; and, indisputably, this system contains more thereof than any other before the public. The simple rules are laid down in a manner not hitherto given by any author; and what is commonly called *Long Division*—a rule occupying so much time and difficulty to the learner, and trouble to the teacher—is illustrated by examples, showing the quotient in one line at the bottom, like *Short Division:* thus saving much time and labour to master and scholar. In the compound rules will also be found many useful hints and methods, entirely suited to the business of the day, and well worthy of perusal; and these methods, when fully understood by the pupil, will qualify him to pass through the general routine of business, with that adroitness and facility which every one aspiring to become a good accountant should make his principal study.

From these general observations on the work, we apprehend our readers will be better qualified to go through the system than if left entirely to their own judgment. True, indeed, the work speaks for itself; but still we think there is an absolute necessity in pointing out the improvements and original excellencies in which, we think, our system exceeds others, in directing the attention more fully to those beauties so necessary both in theory and practice.

We hope that the judicious teacher, who has his pupil's interest at heart, will carefully direct him to study these short rules and methods with the most ardent attention, and that neither prejudice nor long contracted habits will prevent him from at once introducing a method that will be creditable to himself and beneficial to the youth committed to his care. These, he must see, will assist the pupil in his ordinary concerns in after life, and in the meantime, give him a taste for proficiency in numbers, that nothing but such brevity of system could produce.

Teachers, we hope, will find this work of the greatest importance to themselves and scholars. The number of examples suited to all ranks and professions, with the shortest methods possible of solution, and the whole deduced from rational principles, will leave nothing wanting for their use and information.

The tables of exchange are copiously given at the end of the work, comprising the coins of the known world, with their English value, as ascertained correctly at the London Mint. This will also be found to be of the greatest utility to merchants and traders who reside in seaport towns, and who transact business with foreign nations. In fact, neither labour nor expense has been spared, to render the work worthy of the highest patronage Royalty could bestow, and with which it has been honoured on its first appearance, nor anything left undone to render the free accession of the present edition admissible into every counting-house, office, and school in the united kingdom. The author, therefore, calculates on the continued support of an enlightened public, and if nothing else accrue, but the diffusion of his plan of ready calculation throughout the rising generation, he rests quite satisfied the public will benefit by it, and he will have attained his object.

THE AUTHOR.

MANCHESTER, MAY, 1853.

INTUITIVE CALCULATIONS.

DEFINITIONS.

1.—Calculation is a method which teaches how to apply the relation of numbers one to another, and by them deduces precepts of computation relative to the affairs of the busy part of mankind. And, in reality, there are but two primary operations, from which the rest are all branches, viz.,—Addition and Subtraction, as will be clearly demonstrated. For Multiplication is but a contracted method of Addition, and Division a contracted mode of Subtraction.

2.—The most part of the objects of our knowledge may be said as being capable of augmentation and diminution; and our ideas of things, as far as they have that tendency, are what we call quantity, by which word may be comprehended whatever can be properly said to have parts. Under this definition we may class extension, weight, motion, time, &c. The one being taken, greater or less, heavier or lighter, swifter, or slower, in proportion to one another of the same kind; and, since the primary property of quantity is the being capable of more or less, quantities may be added to, subtracted from, or multiplied by one another, and consequently divided into the parts they contain.

3.—Unity is that by which everything that is called one is considered. Unity is the beginning of every number.

4.—Number is many composed of units.

5.—A number is said to measure another, when the lesser being taken, a number of times, is exactly equal to the greater, as 8 measureth 24, because 3 times 8 make 24. Unity measureth all numbers.

6.—One number is a multiple of another, when the less measureth the greater, or when the greater containeth the less a number of times exactly.

7.—An aliquot part of a number is that which measureth the said number without a remainder. The number 2 is an aliquot part of 10, being taken 5 times; but 3 is an aliquant part of 10,

because it does not measure 10 without a remainder. Therefore any number that measures another number without a remainder, is called an aliquot number; and any number that does not exactly measure another number, is called an aliquant number.

8.—Numbers consist of digits, articles, compounds, whole, broken, mixed, &c.

9.—Numbers are equal, unequal, even, odd, evenly even, evenly odd, oddly odd, composite, plain, solid, perfect, harmonic, square, cube, &c. &c.

10.—Equal numbers are such as contain an equal number of units.

11.—Unequal numbers are those whose number of units differ.

12.—An even number is that which may be divided into two equal parts.

13.—An odd number is that which cannot be divided into two equal parts.

14.—A number evenly even, is that which an even number measureth by an even number: such is 24, which is the even number 6 measured by the even number 4.

15.—A number evenly odd, is that which an even number measureth by an odd number: such is 12 when the even number 4 measures by the odd number 3.

16.—A number oddly odd, is that which an odd number measureth by an odd number: such is 21, which an odd number 7 measureth by an odd number 3.

17.—A composite number is that which some certain number besides an unit measureth, and consequently hath several aliquot parts: such as 4, 6, 8, 9, 10, 12, 14, 16, and infinite others.

18.—Plain numbers are such as are made of the multiplcation of two, as 6×2 are 12.

19.—A solid number is that which is produced from the multiplication of three numbers; and the numbers that multiply one another are called the sides of the solid number: consequently every solid number is composite. 24 is a solid number, because it is made by the multiplication of three numbers, 2, 3, and 4; for $2 \times 3 = 6$, and $6 \times 4 = 24$.

20.—Perfect numbers are such, whose aliquot parts added together are equal* to themselves: as 6, whose parts are 3,

* If a series of numbers continually proportional from unity in a duplicate ratio be continued until their sum be a prime number, the sum being multiplied into the greatest term shall produce a perfect number. Hence, by the above, may be found all the perfect numbers; because the sums

2, 1, = 6. The second perfect number is 28; for all the aliquot parts thereof are 1, 2, 4, 7, 14, which added together make 28.

21.—Harmonic numbers are such, that the aliquot parts of the one collected, are equal to those of the other number.

22.—A square number is that which is made by the multiplication of two equal numbers, or by the multiplication of any number by itself, which is called a square root. The first square in whole numbers is 4, which is made by multiplying 2 into itself; the second is 9, which is found by 3×3 and so on to infinity.

23.—A cube number is that which is made by the multiplication of three equal numbers; the number itself is called a cube root. The first cube except 1 is 8, which is found by the multiplication of 2 thrice taken, $2\times2=4$ and $4\times2=8$. The second is 27, which is made by the multiplication of 3 taken thrice, as $3\times3=9$ and $9\times3=27$.

24.—In numbers, the ratio or proportion is the mutual habitude of two numbers to one another, and is twofold, either in respect of quantity or quality. In respect of quantity, it is considered between two numbers; the first called the antecedent, the second the consequent, and is equal, as 3 to 3, or unequal, as the greater to the less, 6 to 4, or the less to the greater, 4 to 6.

In respect of quantity, which produce a similitude of reasons called proportion, it is considered between more than two numbers; for though the reason of two numbers may be had as before, yet a similitude of reasons cannot be found, unless the numbers be more than two, and is threefold. First, in respect of their difference; second, of their quote; third, in respect of both.

Of the first ariseth Arithmetical proportion; of the second, Geometrical proportion; of the third, Harmonical proportion.

A Theorem is a proposition whose truth is to be demonstrated.

A Problem is a proposition of something to be done or discovered.

A Lemma is a Theorem instructive to some subsequent proposition, to shorten the proof or practice of it.

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of 1 and 2 are 3, a prime number, $3 \times 2 = 6$, the first perfect number, whose aliquot parts are 1, 2, and 3; and because the sums of 1, 2, and 4 are 7, a prime number, 7 multiplied by the greatest aliquot part 4, make 28, the second perfect number, whose aliquot parts are 1, 2, 7, and 14. Again, the sums of 1, 2, 4, 8, and 16, are 31, a prime number $= 31 \times 16 = 496$, the third perfect number. The aliquot of the next are 1, 2, 4, 8, 16, 31, 62, 124, 248.

A Corollary is a proposition gained by one whose truth is evident from the truth or demonstration of another.

A Demonstration is an infallible proof of the truth or falsity of propositions.

AXIOMS.

1.—Those things which are equal to the same thing are equal to one another.

2.—If equals be added to equals, the whole shall be equal.

3.—If equals be taken from equals, the remainder shall be equal.

4.—If equals be multiplied by equals, the product shall be equal.

5.—If equals be divided by equals, the quotient shall be equal.

6.—The whole is equal to all its parts.

A Postulate is something granted on which to found a proof.

An Axiom is a proposition whose truth is self-evident.

A Proposition is whatever is affixed or proposed, either as matter of assent, practice, or speculation.

Propositions are divided into Theorems, Problems, Lemmas, and Corollaries.

Numeration is the first principal part of Computation, and teaches how to read, write, value, or express any number of figures, and consists of two parts.

1.—The due order of setting down figures.

2.—The value of each figure in its proper place.

NOTATION AND NUMERATION TABLES.

PLACE									
*1st.—Units	1	21	321	4321	54321	654321	7654321	Units.	
2nd.—Tens	2	32	432	5432	65432	765432	8765432		
3rd.—Hundreds	3	43	543	6543	76543	876543	9876543		
4th.—Thousands	4	54	654	7654	87654	987654	10987654		
5th.—Tens of Thousands	5	65	765	8765	98765	1098765	11098765		
6th.—Hundreds of Thousands	6	76	876	9876	109876	1109876	12109876		
7th.—Millions	7	87	987	10987	110987	121098	13121098	Millions.	
8th.—Tens of Millions	8	98	1098	11098	121098	132109	14132109		
9th.—Hundreds of Millions	9	109	1109	12109	132109	143210	15143210		
10th.—Thousands of Millions	10	110	1210	13210	143210	154321	16154321		
11th.—Tens of Thousands of Millions	11	121	1321	14321	154321	165432	17165432		
12th.—Hundreds of Thousands of Millions	12	132	1432	15432	165432	176543	18176543		

* The first period is called Units, the second Millions, the third Billions, the fourth Trillions, the fifth Quadrillions, &c., and so on to Quintillions, Sextillions, Septillions, Octillions, &c.; and when the pupil can read one period well, he may read any length of figures whatever.

13th.—Billions, or Millions of Millions	4	Billions.
14th.—Tens of Billions	5	
15th.—Hundreds of Billions	6	
16th.—Thousands of Billions	7	
17th.—Tens of Thousands of Billions	8	
18th.—Hundreds of Thousands of Billions	9	
19th.—Trillions	1	Trillions.
20th.—Tens of Trillions	2	
21st.—Hundreds of Trillions	3	
22nd—Thousands of Trillions	4	
23rd.—Tens of Thousands of Trillions	5	
24th.—Hundreds of Thousands of Trillions	6	
25th.—Quadrillions	7	

NOTATION BY LETTERS.

I.	One	XII.	Twelve	L.	Fifty
II.	Two	XIII.	Thirteen	C.	One Hundred
III.	Three	XIV.	Fourteen	D.	Five Hundred
IV.	Four	XV.	Fifteen	DC.	Six Hundred
V.	Five	XVI.	Sixteen	M.	One Thousand
VI.	Six	XVII.	Seventeen	$\overline{V}$.	Five Thousand
VII.	Seven	XVIII.	Eighteen	$\overline{X}$.	Ten Thousand
VIII.	Eight	XIX.	Nineteen	$\overline{L}$.	Fifty Thousand
IX.	Nine	XX.	Twenty	$\overline{C}$.	One Hundred Th.
X.	Ten	XXX.	Thirty	$\overline{D}$.	Five Hundred Th.
XI.	Eleven	XL.	Forty	$\overline{M}$.	One Million

ADDITION.

ADDITION of whole numbers is the second essential point of computation, and teaches of several numbers of the same denomination to make one total, called their sum.

RULE.—Set down all the numbers to be added, as in the following example; but observe to set no figure in the same column that is not of the same value, or place, and draw a line under them.

2.—Begin at the place of units, add up that column, and find how many tens are contained therein.

3.—Set down what remains above the tens, or, if nothing remain, write down a cipher. and carry* as many ones to the next column as there were tens in this.

4.—Proceed with the second column in like manner, and so on till all be finished.

* *Reason for carrying one for every ten.*—Because ten units in the first column towards the right hand make an unit in the next row towards the left; therefore the reason for carrying one for every ten is evident; and the method of placing the figures is no less evident, because any other arrangement of them would alter their value. This rule is founded on the known axiom "the whole is equal to all its parts." (See Axiom 6.)

EXAMPLES.

1.

5 4 7 8 6 7	
4 6 6 4 3 2	
6 7 4 8 3 4	
7 5 2 3 4 2	
8 3 7 6 5 6	
3 2 7 9 1 3 1	Sum.
2 7 3 1 2 6 4	
3 2 7 9 1 3 1	Proof.

2.

8 5 4 7 6 3	
6 8 6 5 4 2	
5 7 6 4 8 3	
3 4 2 8 6 5	
7 9 8 7 5 2	
3 2 5 9 4 0 5	Sum.
2 4 0 4 6 4 2	
3 2 5 9 4 0 5	Proof.*

3.

4 7 6 8 3 4 8	
7 3 5 8 6 3 4	
6 7 8 5 4 7 3	
8 6 4 2 3 4 7	
5 3 6 4 8 2 4	
3 7 8 6 4 3 6	
8 6 7 5 3 8 7	
7 5 3 7 6 4 2	
8 9 7 6 4 3 2	
6 1 8 9 5 5 2 3	Sum.

4.

5 8 7 6 4 3 9	
8 3 6 7 6 4 3	
9 8 7 6 4 7 6	
5 7 6 3 7 6 4	
9 8 7 6 3 7 8	
6 4 6 3 7 6 4	
5 3 7 6 4 7 8	
8 2 3 7 6 4 2	
3 7 8 6 4 2 3	
6 3 6 2 5 0 0 7	Sum.

A NEW AND EXPEDITIOUS METHOD FOR TEACHERS IN SCHOOLS.

In arranging the question, set it so that every two figures at units place make ten in the place of tens, and to the end, every two figures to make nine. The key line may be put at the top, bottom, or middle of the question; which line will be the sum required.

EXAMPLES.

5.

4 7 6 5 3 8	
5 2 3 4 6 2	
7 5 4 6 3 4	
2 4 5 3 6 6	
8 6 4 7 8 3	
1 3 5 2 1 7	
4 8 3 7 6 2	
5 1 6 2 3 8	
1 2 3 4 4 6	K. L.
4 1 2 3 4 4 6	Sum.

6.

7 8 6 4 7 5	
2 1 3 5 2 5	
3 7 8 6 5 4	
6 2 1 3 4 6	
8 3 4 2 7 8	K. L.
7 6 3 4 2 1	
2 3 6 5 7 9	
4 2 3 4 5 6	
5 7 6 5 4 4	
4 8 3 4 2 7 8	Sum.

* *Method of Proof.*—First, draw a line between the two first lines, and suppose the head line cut off; second, add all the rest together, and set their sum under the number to be proved; third, add the last line found to the upermost line cut off, and if the sum be the same as that found by the first addition, the work is right.

7.								
	1	2	5	6	3	4	K. L.	
	7	8	6	5	4	3		
	2	1	3	4	5	7		
	3	4	5	2	4	1		
	6	5	4	7	5	9		
	7	8	6	5	4	2		
	2	1	3	4	5	8		
	3	7	8	6	4	5		
	6	2	1	3	5	5		
	4	1	2	5	6	3	4	Sum

8.								
	4	5	8	3	4	2		
	5	4	1	6	5	8		
	7	8	6	4	2	3		
	2	1	3	5	7	7		
	6	2	5	4	8	3		
	3	7	4	5	1	7		
	8	4	3	4	7	8		
	1	5	6	5	2	2		
	1	0	0	0	0	3	K. L.	
	4	1	0	0	0	0	3	Sum.

9.								
	6	7	3	4	7	6	5	
	3	2	6	5	2	3	5	
	8	9	0	1	7	9	4	K. L.
	4	7	8	6	4	7	6	
	5	2	1	3	5	2	4	
	7	9	6	4	3	5	2	
	2	0	3	5	6	4	8	
	3	7	6	4	3	5	7	
	5	2	3	5	6	4	3	
	4	8	9	0	1	7	9	4

10.								
	7	8	6	4	3	7	8	
	2	1	3	5	6	2	2	
	6	4	3	7	8	6	4	
	3	5	6	2	1	3	6	
	5	3	7	8	6	4	2	
	4	6	2	1	3	5	8	
	3	1	1	7	9	9	9	K. L.
	8	6	4	5	3	7	6	
	1	3	5	4	6	2	4	
	4	3	1	1	7	9	9	9

N.B.—K. L. denotes, Key Line or Sum.

NOTE.—The foregoing plan may be used with great advantage in large schools. Enough has been said to render it explanatory to any capacity.

USE AND APPLICATION.

1.—A merchant, on settling his accounts, finds he owes A. £60, B. £150. C. £240, and to D. £100; I require to know how much he owes in all?—*Ans.* £550.

2.—A merchant is indebted to A. £4600, to B. £370, to C. £6000, to D. £1267, to E. £7640, to F. £60; what sum did he owe in all?—*Ans.* £19937.

3.—A man born in the year 1853, when will he be sixty years old?—*Ans.* 1913.

4.—A merchant receives the following sums, £200, £317, £315, £10, £172, £513, and £9; what is the whole sum?—*Ans.* £1536.

5.—What is the weight of seven casks of merchandise, viz.,—No. 1, weighing 960 lbs.; No. 2, 725 lbs.; No. 3, 830 lbs.; No. 4, 798 lbs.; No. 5, 697 lbs.; No. 6, 569 lbs.; and No. 7, 987 lbs.?—*Ans.* 5566 lbs.

6.—A. borrowed from B. a sum of money, and paid in part, £302, and the remainder is £30; what sum did A. borrow?—*Ans.* £332.

7.—At the Custom House, Liverpool, on the 1st of May, were entered 1200 lbs. of tea; on the 16th, 1479 lbs.; on the day following, 1941 lbs.; the same day, 6195 lbs.; on the four last days of the same month, 1236 lbs., each day; how many lbs. were entered during the month?—*Ans.* 15759 lbs.

8.—An army consisting of 4000 foot soldiers, 4006 cavalry, 3093 light infantry, 1224 gunners, 1400 pioneers, and 200 miners: required the number of the whole army?—*Ans.* 13923 men.

17.

21 ÷ 56 | 7 | 8 | 5 | 4 | 6 | 3 | 5 |
... | 4 | . | . | 1 | . | 0 | 4 |
| 1 | . | . | . | . | 2 | 1 |
Quot. 2 | 7 | 0 | 4 | 0 | 6 | 9 | 6 $\frac{10}{21}$ rem.

18.

26 ÷ 58 | 6 | 7 | 1 | 3 | 4 | 5 | 6 |
... | 6 | 4 | 7 | 5 | 3 | . | . |
| . | 1 | 1 | 1 | 2 | . | . |
Quot. 2 | 2 | 5 | 6 | 5 | 9 | 0 | 2 $\frac{4}{26}$ rem.

19.

28 ÷ 31 | 4 | 7 | 8 | 6 | 9 | 7 | 5 | 4 |
... | 3 | 6 | 1 | 6 | 0 | 5 | 5 | 7 |
| . | . | 1 | . | 1 | 2 | . | 2 |
Quot. 1 | 1 | 2 | 4 | 2 | 3 | 9 | 1 | 9 $\frac{23}{28}$ rem.

20.

32 ÷ 47 | 6 | 9 | 8 | 7 | 5 | 4 | 6 |
... | 5 | 8 | 1 | . | 7 | 9 | 2 |
.... | 1 | 2 | . | . | 2 | 1 | . |
Quot. 1 | 4 | 9 | 0 | 5 | 8 | 6 | 0 $\frac{23}{32}$ rem.

21.

38 ÷ 47 | 8 | 9 | 6 | 5 | 4 | 3 | 2 | 9 |
...
Quot. rem.

22.

45 ÷ 78 | 6 | 4 | 5 | 2 | 3 | 4 | 7 | 8 |
...
Quot. rem.

23.

63 ÷ 78 | 6 | 5 | 4 | 7 | 8 | 6 | 9 | 7 |
...
Quot. rem.

24.

68 ÷ 98 | 7 | 6 | 5 | 4 | 7 | 8 | 6 | 8 |
...
Quot. rem.

25.

75 ÷ 86 | 9 | 7 | 8 | 6 | 4 | 8 | 6 | 9 |
...
Quot. rem.

26.

84 ÷ 78 | 6 | 5 | 4 | 7 | 8 | 6 | 5 | 7 |
...
Quot. rem.

27.

94 ÷ 105 | 6 | 7 | 8 | 6 | 9 | 8 | 4 | 7 |
...
Quot. rem.

28.

98 ÷ 145 | 6 | 7 | 8 | 6 | 4 | 7 | 4 | 8 |
...
Quot. rem.

29.

234 ÷ 786 | 7 | 8 | 5 | 4 | 3 | 6 | 5 | 4 |
...
Quot. rem.

30.

346 ÷ 786 | 9 | 8 | 9 | 8 | 6 | 4 | 2 | 7 |
...
Quot. rem.

31.

2465 ÷ 7869 | 7 | 6 | 5 | 4 | 3 | 2 | 7 | 8 |

Quot. rem.

32.

5786 ÷ 1543 | 4 | 8 | 3 | 7 | 6 | 9 | 5 | 8 |

Quot. rem.

33.

9876 ÷ 58647 | 8 | 9 | 0 | 1 | 6 | 5 | 7 | 9 |

Quot. rem.

34.

24786 ÷ 78654 | 7 | 8 | 6 | 9 | 7 | 6 | 8 | 9 |

Quot. rem.

35.

10765 ÷ 87654 | 8 | 7 | 6 | 5 | 4 | 6 | 8 | 9 |

Quot. rem.

36.

27654 ÷ 98765 | 7 | 8 | 6 | 4 | 5 | 9 | 7 | 6 |

Quot. rem.

The brevity of this new method of division will be easily discovered, as there is no question in the above exceeds ten figures, independent of the quotient.

NOTE.—To perform by division is the converse of that by multiplication: divide the lowest denomination by so many of these as make one of the greater.

What is simple division?
How many given numbers hath it?
What do you call the number you divide by?
What term do you give the number to be divided?
What is the result called?
Can you divide by composite numbers?
How do you prove division?

REDUCTION

OF COINS, WEIGHTS, AND MEASURES.

REDUCTION is twofold, viz.,—descending and ascending. First, all great names are brought into small ones by multiplying with so many of the lesser as make one of the greater; second, all small names are brought into greater by dividing with so many of the less as make one of the greater.

To perform by multiplication, reduce the greatest denomination to the next less, adding in the numbers of the less denomition; reduce this sum to the next lower denomination, adding the numbers belonging thereto, and so proceed till all be done.

☞ In the early ages of commerce there was little or no occasion for computation, one commodity was generally bartered for another by bulk; but as civilization advanced, improvements were made, and something was daily added to the convenience of life. To remove the difficulty of bartering in kind, one commodity was generally agreed upon. To determine the substance of greatest esteem, gold and silver were universally adopted, being the most precious metals; but as the expense in the working of gold was by much greater than the charge for working silver, the greater value was justly ascribed to the former. It was then found necessary to fix a proportion between these metals; and hence it is a fixed rate throughout the greater part of Europe, that one ounce of gold is worth about fifteen ounces of silver: however, as improvements increased, and to give greater facility to traffic, it was soon afterwards found necessary to make coins impressed with a mark of distinction, expressing the quantity each piece contained; therefore the pound troy was selected as the proper standard to regulate the money of this realm. Two centuries before the conquest, Osbright, then King of England, had one ounce troy of silver divided into twenty pieces, called pence, so that an ounce of silver then was not worth more than 1s. 8d., which continued until the reign of Henry VII., who valued the same at 2s. 6d., and continued so until the time of Edward IV., who valued the ounce at 3s. 4d. After this, Henry VIII. valued the ounce of silver at 3s. 9d., which continued till Queen Elizabeth's time: she increased the value of the ounce Troy to 5s., as it remains to this day.

MONEY TABLE.*

FARTHINGS.				PENCE.				SHILLINGS.			
QR.		S.	D.	D.		S.	D.	S.		£.	S.
4	are		1	12	are	1	0	20	are	1	0
8	.....		2	20	.....	1	8	30	.....	1	10
12	.....		3	24	.....	2	0	40	.....	2	0
16	.....		4	30	.....	2	6	50	.....	2	10
20	.....		5	36	.....	3	0	60	.....	3	0
24	.....		6	40	.....	3	4	70	.....	3	10
28	.....		7	48	.....	4	0	80	.....	4	0
32	.....		8	50	.....	4	2	90	.....	4	10
36	.....		9	60	.....	5	0	100	.....	5	0
40	.....		10	70	.....	5	10	110	.....	5	10
44	.....		11	72	.....	6	0	120	.....	6	0
48	.....	1	0	80	.....	6	8	130	.....	6	10
52	.....	1	1	84	.....	7	0	140	.....	7	0
56	.....	1	2	90	.....	7	6	150	.....	7	10
60	.....	1	3	96	.....	8	0	160	... ..	8	0
64	.....	1	4	100	.....	8	4	170	.....	8	10
68	.....	1	5	108	.....	9	0	180	.....	9	0
72	.....	1	6	110	.....	9	2	190	.....	9	10
76	.....	1	7	120	.....	10	0	200	.....	10	0
80	.....	1	8	130	.....	10	10	210	.....	10	10
84	.....	1	9	132	.....	11	0	220	.....	11	0
88	.....	1	10	140	.....	11	8	230	.....	11	10
92	.....	1	11	144	.....	12	0	240	.....	12	0
96	.....	2	0	150	.....	12	6	250	.....	12	10
100	.....	2	1	156	.....	13	0	260	.....	13	0
104	.....	2	2	160	.....	13	4	270	.....	13	10
108	.....	2	3	168	.....	14	0	280	.....	14	0
112	.....	2	4	170	.....	14	2	290	.....	14	10

* Q. denote farthings, D. pence, S. shillings, and £ pounds sterling.

EXTENDED PENCE TABLE.

D.	£.	S.	D.	D.	£.	S.	D.	D.	£.	S.	D.
200 ...	0	16	8	1500 ...	6	5	0	4000 ...	16	13	4
240 ...	1	0	0	1680 ...	7	0	0	4500 ...	18	18	4
300 ...	1	5	0	1920 ...	8	0	0	5000 ...	20	16	8
400 ...	1	13	4	2000 ...	8	6	8	5500 ...	22	18	4
480 ...	2	0	0	2160 ...	9	0	0	6000 ...	25	0	0
500 ...	2	1	8	2400 ...	10	0	0	6500 ...	27	1	8
600 ...	2	10	0	2500 ...	10	8	4	7000 ...	29	3	4
700 ...	2	18	4	2640 ...	11	0	0	7500 ...	31	5	0
720 ...	3	0	0	2880 ...	12	0	0	8000 ...	33	6	8
800 ...	3	6	8	3000 ...	12	10	0	8500 ...	35	8	4
900 ...	3	15	0	3120 ...	13	0	0	9000 ...	37	10	0
960 ...	4	0	0	3360 ...	14	0	0	9500 ...	39	11	8
1000 ...	4	3	4	3500 ...	14	11	8	10000 ...	41	13	4
1200 ...	5	0	0	3600 ...	15	0	0	11000 ...	45	16	8
1440 ...	6	0	0	3840 ...	16	0	0	12000 ...	50	0	0

GENERAL RULE.—All great names are made less by multiplication. All less names are made greater by division. Consequently, pounds multiplied by 20 are shillings, shillings multiplied by 12 are pence, pence multiplied by 2 are halfpence, and halfpence multiplied by 2 are farthings. Farthings divided by 2 are halfpence, halfpence divided by 2 are pence, pence divided by 12 are shillings, and shillings divided by 20 are pounds.

EXAMPLES.

1.—Reduce £247 to shillings.

20

Ans. £4940.

2.—Reduce 468s. to pence.

12

Ans. 5616d.

3.—Reduce 273d. to farthings.

4

Ans. 1092q.

4.—Reduce £55 19s. 7d. to pence.

20

1119

12

Ans. 13435d.

5.—Reduce £754 17s. 9¼d. to farthings.

20

15097

12

181173

4

Ans. 724659q.

6.—In 7656s. how many pounds?

765,6s.

2,0+

Ans. 382. 16s.

7.—In 89594d. how many shillings?

89594d.

12 +

Ans. 7466s. 2d.

8.—In 47648q. how many pence?
47648q.
4 +
Ans. 11912d.

9.—In £7 how many pence?
£7
240
Ans. 1680d.

10.—In 1680d. how many pounds?
240 ÷ 1680d.
.
.
Ans. £7

11.—In 345600q. how many pounds?
960 ÷ 345600q.
6.
7.
5.
Ans. £360

12.—In £23 how many pence?
£23
240
Ans. 5520d.

13.—In 5520d. how many pounds?
240 ÷ 5520 . d.
2.
7.
Ans. £23

14.—In 960000q. how many pounds?
960 ÷ 960000q.
...
...
...
Ans. £1000

15.—In £1000 how many farthings?
£1000
960
Ans. 960000q.

16.—In 84480 halfpence how many pounds?
480 ÷ 84480.
48.
68.
32.
Ans. £176

17.—In £478 how many pence?
£478
240
Ans. 114720d.

18.—In 114720d. how many pounds?
240 ÷ 114720d.
72.
89.
11.
Ans. £478

19.—In £2160 how many pence?
£2160
240
Ans. 518400d.

20.—In 518400d. how many pounds?
240 ÷ 518400d.
84.
34.
.1.
Ans. £2160

21.—In £3120 how many pence?
£3120
240
Ans. 748800d.

22.—In 748800d. how many pounds?

240 ÷ 748800d.
88.
24.

Ans. £3120

23.—In £7684 how many farthings?

£7684
960

Ans. 7376640q.

24.—In 7376640q. how many pounds?

960 ÷ 7376640q.
664.
508.
683.

Ans. £7684

25.—In £23576 how many half-pence?

£23576
480

Ans. 11316480 halfpence.

The above examples will suffice; but the judicious teacher may extend the principle as far as, to the advantage of his pupils, he may deem right.

NOTE.—The readiest way to reduce pounds, shillings, and pence, to pence, is to multiply the pounds by 240, to which add the pence of the shillings and pence; and to bring farthings to pounds, divide the farthings by 960, and the result will be pounds.

QUERIES.

What is reduction?
What does reduction ascending mean?
What does reduction descending signify?
How is reduction proved?
How do you bring pounds to farthings?
How do you bring farthings to pounds?
How do you bring half-pence to pounds? and *vice versa*.

WEIGHTS AND MEASURES.

TROY WEIGHT.

TROY WEIGHT has its name from Troyes, a town in France, in the province of Champagne, and department of the Aube, and was introduced by William the Conqueror: by it are weighed gold, silver, jewels, and liquors. Its denominations are as follow:—

4 Grains.....	make	1 Carat.
6 Carats, or 24 Grains	... ...	1 Pennyweight.
20 Pennyweights...	... ...	1 Ounce.
12 Ounces ...	... ...	1 Pound.
25 Pounds ...	... ...	1 Quarter.
100 Pounds ...	... ...	1 Hundred weight.
20 Hundred weight	... ...	1 Ton of gold or silver.

NEW TABLE OF TROY WEIGHT.

OZ.	DWTS.	QRS.	lb.	OZ.	DWTS.	GRS.
12	0	0	1	12	240	5760
0	20	0	$\frac{1}{12}$	1	20	480
0	1	24	$\frac{1}{240}$	$\frac{1}{24}$	1	24
0	0	1	$\frac{1}{5760}$	$\frac{1}{480}$	$\frac{1}{24}$	1
6	0	0	$\frac{1}{2}$	.....	.....	.....
4	0	0	$\frac{1}{3}$	.....	.....	.....
3	0	0	$\frac{1}{4}$	.....	.....	.....
2	8	0	$\frac{1}{5}$	.....	.....	.....
2	0	0	$\frac{1}{6}$	.....	.....	.....
1	10	0	$\frac{1}{8}$	.....	.....	.....
1	0	0	$\frac{1}{12}$	.....	.....	.....
0	10	0	$\frac{1}{24}$	$\frac{1}{2}$	.....	.....
0	6	16	$\frac{1}{30}$	$\frac{1}{3}$	.....	.....
0	5	0	$\frac{1}{48}$	$\frac{1}{4}$	.....	.....
0	4	0	$\frac{1}{60}$	$\frac{1}{5}$	.....	.....
0	3	8	$\frac{1}{72}$	$\frac{1}{6}$	.....	.....
0	2	12	$\frac{1}{96}$	$\frac{1}{8}$	.....	.....
0	2	0	$\frac{1}{120}$	$\frac{1}{10}$	.....	.....
0	1	16	$\frac{1}{144}$	$\frac{1}{12}$	.....	.....
0	1	0	$\frac{1}{240}$	$\frac{1}{20}$	1	.....
0	0	12	$\frac{1}{480}$	$\frac{1}{40}$	$\frac{1}{2}$	.....
0	0	6	$\frac{1}{960}$	$\frac{1}{80}$	$\frac{1}{4}$	.....
0	0	4	$\frac{1}{1440}$	$\frac{1}{120}$	$\frac{1}{6}$	.....
0	0	3	$\frac{1}{1920}$	$\frac{1}{160}$	$\frac{1}{8}$	.....
0	0	2	$\frac{1}{2880}$	$\frac{1}{240}$	$\frac{1}{12}$	.....
0	0	1	$\frac{1}{5760}$	$\frac{1}{480}$	$\frac{1}{24}$	.....

RULE.—Pounds multiplied by 12, are ounces; ounces multiplied by 20 are pennyweights; pennyweights multiplied by 24, are grains. Grains divided by 24 are pennyweights; pennyweights divided by 20 are ounces; ounces by 12 are pounds.

EXAMPLES.

26.—In 24 lb. troy, how many ounces, pennyweights, and grains?—*Ans.* 288 oz. 5760 dwts. 138240 grs.

27.—How many pounds troy in 138240 grains?—*Ans.* 24 lb.

28.—How many pounds troy are in 85960 grains?—*Ans.* 14 lb. 11 oz. 1 dwt. 16 grs.

29.—In 14 lb. 11 oz. 1 dwt. 16 grs. how many grains?—*Ans.* 85960 grs.

30.—In 75 lb. 11 oz. 19 dwts. 23 grs., how many grains?—*Ans.* 437759 grs.

31.—In 437759 grains, how many pounds troy?—*Ans.* 75 lb. 11 oz. 19 dwts. 23 grs.

32.—In 16 lb. 0 oz. 14 dwts. 21 grs., how many grains?—*Ans.* 92517 grs.
33.—In 92517 grains, how many pounds troy?—*Ans.* 16 lb. 0 oz. 14 dwts. 21 grs.
34.—Sold 8 silver teapots, each weighing 3 lb. 9 oz. 18 dwts. 13 grains, how many grains were in all?—*Ans.* 176360 grs.
35.—In 176360 grains, how many pounds?—*Ans.* 3 lb. 9 oz. 18 dwts. 13 grs.
36.—What quantity of gold will it require to make twelve ornaments, each weighing 1 oz. 18 dwts. 12 grs.—*Ans.* 23 oz. 2 dwts.
37.—How many silver tablespoons, each weighing 4 oz. 14 dwts. can be made out of 2 lb. 4 oz. 4 dwts. of silver.—*Ans.* 6 spoons.

QUERIES.

How do you bring lbs. troy into grains?
How do you bring grains into lbs?
How many grains in a lb. troy?
What are the goods usually weighed by troy weight?

AVOIRDUPOIS WEIGHT*

Signifies a medium of weight: by it are weighed all goods that are subject to waste, as groceries of all kinds, tallow, pitch, hemp, flax, wool, and all kinds of metals, except gold and silver.

COMMON WEIGHT.

16 drs.	1 oz.	2 stone or 28 lb.	1 qr.
16 oz.	1 lb.	4 qrs.	1 cwt.
14 lb.	1 stone.	20 cwt.	1 ton.

WOOL WEIGHT.

In some parts of England, 15 lb. make a stone; in Ireland, 16 lb. to the stone.

England.

15 lb.....	1 stone.
2 stones or 30 lb..	1 tod.
8 tods or 240 lb....	1 pack or sack.

Otherwise.

7 lb....	1 clove.
2 cloves	1 stone.
2 stones	1 tod.
6½ tod	1 wey.
2 weys	1 sack.
12 sacks	1 last.

---

* The corresponding proportion between avoirdupois and troy weight.

1 lb. Avoirdupois weight = 14 oz. 11 dwts. 15½ grs. troy.
1 oz. „ „ = 48 dwts. 5½ grs.
1 dr. „ „ = 1 dwt. 3½ grs.

A pound avoirdupois contains 7000 grains nearly, and a pound troy 5770 grains, consequently they are to each other as 17 to 14; or multiply the pounds troy by 114, and divide by 175, and you will have the pounds avoirdupois.

NEW TABLE OF AVOIRDUPOIS WEIGHT.

CWT.	QRS.	LBS.		TON.	CWT.	QRS.	STONE.	LB.	OZ.	DRS.
20	0	0	are	1	20	80	160	2240	35840	573440
10	0	0	...	$\frac{1}{2}$	...	...	...	...	...	...
5	0	0	...	$\frac{1}{4}$	...	...	...	...	...	...
4	0	0	...	$\frac{1}{5}$	...	...	...	...	...	...
2	3	12	...	$\frac{1}{7}$	...	...	...	...	...	...
2	2	0	...	$\frac{1}{8}$	...	...	...	...	...	...
2	0	0	...	$\frac{1}{10}$	...	...	...	...	...	...
1	1	0	...	$\frac{1}{16}$	...	...	...	...	...	...
0	2	0	...	$\frac{1}{40}$	$\frac{1}{2}$	...	...	...	...	...
0	1	0	is	$\frac{1}{80}$	$\frac{1}{4}$	1	...	...	...	...
1st.	0lb.		are	$\frac{1}{160}$	$\frac{1}{8}$	$\frac{1}{2}$	1	...	...	...
0	8		...	$\frac{1}{280}$	$\frac{1}{14}$	$\frac{2}{7}$	$\frac{4}{7}$	8	...	...
0	7		...	$\frac{1}{320}$	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{1}{2}$	7	...	...
0	4		...	$\frac{1}{560}$	$\frac{1}{28}$	$\frac{1}{7}$	$\frac{2}{7}$	4	...	...
0	$3\frac{1}{2}$		...	$\frac{1}{640}$	$\frac{1}{32}$	$\frac{1}{8}$	$\frac{1}{4}$	$3\frac{1}{2}$	...	...
0	1		is	$\frac{1}{2240}$	$\frac{1}{112}$	$\frac{1}{28}$	$\frac{1}{14}$	1	...	...
	1oz.		...	$\frac{1}{35840}$	$\frac{1}{1792}$	$\frac{1}{448}$	$\frac{1}{224}$	$\frac{1}{16}$	1	...
	1dr.		...	$\frac{1}{573440}$	$\frac{1}{28672}$	$\frac{1}{7168}$	$\frac{1}{3584}$	$\frac{1}{256}$	$\frac{1}{16}$	1

CUSTOMARY WEIGHTS USED IN BUYING AND SELLING THE FOLLOWING COMMODITIES:—

	lb.
A Firkin of Butter is	56
A Firkin of Soap	64
A Barrel of Soap	256
A Barrel of Pot Ashes	200
A Barrel of Anchovies	30
A Barrel of Figs from 96 lbs. to 2¼ cwt.	
A Barrel of Candles	120
A Barrel of Butter	224
A Puncheon of Prunes, 10 or 12 cwt.	
A Fother of Lead, 19 cwt. 2 qrs. or	2184
A Stone of Iron or Shot... ...	14
A Gallon of Train Oil	10¼
A Fagot of Steel	120

CUSTOMARY WEIGHT OF GOODS CONTINUED.

	lb.
A Stone of Glass	5
A Quintal of Fish in Newfoundland	100
A Seam of Glass, 24 stone, or	120
A Stone of Cheese	16
A Stone of Meat in London ...	8
A Stone of Meat in the Country	14
A Stone of Hemp	32
A Stone, Horseman's Weight...	14
A Chest of Tea	84
A Load of Meal, Potatoes ..	240

	lb.	oz.	dr
A Peck Loaf Weighs ...	17	6	1
A Half-Peck...	8	11	0
A Quartern	4	5	8
A Peck (or Stone) of Flour	14	0	0
A Bushel of Flour ...	56	0	0
A Barrel of American Flour	196	0	0
A Pack, or Load of Flour	240	0	0
A Sack or five Bushels of Flour*	280	0	0

THE COMMON SIZES OF BOOKS ARE

Folio, ...	of which	2	leaves	make a	sheet	ffo.
Quarto, ...	,,	4	,,	,,	,,	4to.
Octavo, ...	,,	8	,,	,,	,,	8vo.
Duodecimo,...	,,	12	,,	,,	,,	12mo.
Octodecimo, ..	,,	18	,,	,,	,,	18mo.

LAW.

90 words in Chancery, 1 folio | 80 words in Exchequer, 1 folio
72 words in Common Law, 1 folio.
A roll of parchment, 5 dozen of skins.

Tons	×	by 20 are cwts.	Drs.	÷	by 16 are oz.
Cwts.	×	by 4 are qrs.	Oz.	÷	by 16 are lbs.
Qrs.	×	by 28 are lbs.	Lbs.	÷	by 28 are qrs.
Lbs.	×	by 16 are oz.	Qrs.	÷	by 4 are cwts.
Oz.	×	by 16 are drs.	Cwts.	÷	by 20 are tons.

A COMPENDIOUS METHOD OF REDUCING HUNDREDS, QUARTERS, AND POUNDS, TO POUNDS.

RULE.—Multiply the cwts. by 12, and to the product mentally add the lbs. of the odd weight, which sum is to be so placed under the cwts., that the place of cwts. in this may fall under the units of that: the whole added will give the answer.

* In some parts of England, a sack of flour is 18 stones, or 252 pounds.

EXAMPLES.

38.—123 cwt. 3 qrs. 10 lb. how many lbs.?

cwt.	qrs.	lbs.	lbs.
123	3	10	= 94
1576*			

Ans. 13870 lbs.

Or thus:

cwt.	qrs.	lbs.
123	3	10
123		
123		
12394		

Ans. 13870 lbs.

The common method.

cwt.	qrs.	lbs.
123	3	10
4		
495		
28		
3960		
991		

Ans. 13870 lbs.

39.—In 36 cwt. 1 qr. 13 lbs. how many lbs.?

cwt.	qrs.	lbs.
36	1	13
113		

Ans. 4073 lbs.

40.—In 75 cwt. 3 qrs. 14 lbs. how many lbs.?

cwt.	qrs.	lbs.
75	3	14
998		

Ans. 8498 lbs.

41.—In 273 cwt. 2 qrs. 19 lbs. how many lbs.?

cwt.	qrs.	lbs.
273	2	19
3351		

Ans. 30651 lbs.

42.—In 13870 lbs. how many cwts.?

lbs.

112 ÷ 13870 | 28 ÷ 94 | 10
6 | 3
2 | 4

Ans. cwt. 123 3 10

43.—In 264 cwt. 3 qrs. 12 lbs. 11 oz. how many oz.?—*Ans.* 474635 oz.
44.—In 474635 oz. how many cwts.?—*Ans.* 264 cwt. 3 qrs. 12 lbs. 11 oz.
45.—In 139 cwt. 1 qr. 22 lbs. 13 oz. how many oz.?—*Ans.* 249901 oz.
46.—In 249901 oz. how many cwts.?—*Ans.* 139 cwt. 1 qr. 22 lbs. 13 oz.
47.—In 976 cwt. 3 qrs. 27 llbs. how many lbs.?—*Ans.* 109423 lbs.
48.—Bought 24 bags of flour, each weighing 2 cwt. 2 qrs. 13 lbs., how many lbs. in all?—*Ans.* 7032 lbs.
49.—In 3 cwt. 2 qrs. 14 lbs. of sugar, how many parcels are there, each containing half a pound?—*Ans.* 812 parcels.

QUERIES.

How do you bring lbs. avoirdupois to drachms?
How do you bring drachms into pounds weight?
How do you bring cwts., qrs., and lbs. to lbs.?
How do you bring lbs. to cwts?—Tons, cwts., qrs., and lbs. to lbs., and the reverse?

* The new method, 4 figures, exclusive of the answer; the common method, 14.

To bring Short Weight to Long, and Long Weight to Short.

GENERAL RULE.—From the short weight in cwts., qrs., and lbs., take the $\frac{1}{15}$ of itself, and the remainder is long weight; and to the long weight in cwt., qrs., and lbs., add its $\frac{1}{14}$, and it is short weight of 112 lbs. to the cwt.

Reason.—8 lbs. being the difference—112 lbs. in one case, and 120 in the other. 8 is the 14th of 112, and the 15th of 120; consequently, the 15th taken from the short weight, leaves the long weight of 120 lbs. to the cwt.; and the 14th added to the long weight, makes the short weight of 112 lbs. to the cwt.

EXAMPLES.

50.—In 135 cwt. of 112 lbs. how many cwts. of 120 lbs.?—*Ans.* 126 cwt.

51.—In 347 cwt. 1 qr. 16 lbs., short weight, how many long weight?—*Ans.* 324 cwt. 0 qrs. $26\frac{2}{15}$ lbs.

52.—In 45 cwt. 1 qr. 17 lbs., short weight, how many long?—*Ans.* 42 cwt. 1 qr. 14 lbs.

53.—In 45 cwt. 1 qr. 16 lbs. long weight, how much short weight?—*Ans.* 48 cwt. 2 qrs. 15 lbs.

54.—In 176 cwt. 3 qrs. 19 lbs., long weight, how much short weight?—*Ans.* 189 cwt. 2 qrs. 5 $\frac{5}{14}$ lbs.

How do you bring long weight to short, and the reverse?

APOTHECARIES' OR CHEMISTS' WEIGHT

Is the same as troy weight in value; an apothecaries' lb. is = to a pound troy, and contains the same number of oz. and grs.; but instead of dwts. the oz. is divided into *scruples* and *drachms:* by it chemists and apothecaries compound their materials, but buy and sell by avoirdupois. Its denominations are—grains, scruples, drachms, ounces, and pounds.

20 grains	1 scruple ℈	8 drachms...	1 ounce ℥
3 scruples	1 drachm ʒ	12 ounces	1 pound ℔

RULE *for reducing to the lowest, or bringing to the highest denomination.*

Lbs. × by 12 are ounces.	Grs. ÷ by 20 are scruples.
Oz. × by 8 are drachms.	Scrs. ÷ by 3 are drachms.
Drs. × by 3 are scruples.	Drs. ÷ by 8 are ounces.
Scrs. × by 20 are grains.	Oz. ÷ by 12 are pounds.

NOTE.—The same grain, ounce, and pound, as troy weight, only differently divided and subdivided.

APOTHECARIES' FLUID MEASURE.

60 minims*	make	1 fluidrachm.	ʒ
8 fluidrachms		1 fluid ounce.	℥
16 fluid ounces		1 pint.	0
8 pints		1 gallon.	*cong.*

* The Edinb. and Dublin Colleges still retain the term *gutta* (drop) instead of *minim*.

ABBREVIATIONS EMPLOYED BY THE FACULTY IN PRESCRIPTIONS, &c.

℞. *for* recipe, take
ss. *for* semis, the half
cochl. cochleare, a spoonful
q. s. quantum sufficit a sufficient quantity.
cong. congius, a gallon.

M. Manipulus, a handful, *or* M. *for* Misce, mix.

℈. (pugillus) as much as can be taken between the two forefingers and the thumb.

The quantities in prescriptions are expressed by small Roman numerals; thus:—

gt. j. for gutta 1, 1 drop.
♏ ij. 2 minima *or* drops.
♏ iv. 4 minima.
♏ xij. 12 minima.
gr. xxvj. 26 grains.
℈ j. 1 scruple.
℈ ss. half a scruple.
ʒ vij. 7 drachms.
ʒ iiss. 3½ drachms.
f ʒ ij. 2 fluidrachms.
℥ j. 1 ounce.
℥ ss. half ounce.
lb. iiss. 2½ lbs.
O. iij. 3 pints

EXAMPLES.

66.—*How many pounds in 4926 scruples?*—*Ans.* 17 lbs.
66. A patient is allowed to take daily 2 drs. 2 scrs. of bark, how long will 7 lbs. last him?—*Ans.* 252 days.
67.—*How many grains are in* 231 lbs. 3 oz. 5 grs.?—*Ans.* 1332005 grs.
68.—*In* 1332005 *grains how many pounds?*—*Ans.* 231 lbs. 3 oz. 5 grs.
69.—*In* 7 oz. 5 drs. 3 scr. *how many scruples?*—*Ans.* 186 scruples.

LINEAL, OR LONG MEASURE.

3 barley-corns, b. c. are ... ... 1 inch, in.
4 inches, *or* 12 b. c. ... ... 1 hand, h.
12 inches, *or* 3 h. ... ... 1 foot, ft.
3 feet, *or* 36 inches. ... ... 1 yard, yd.
5½ feet, *or* 66 in. ... ... 1 pace, p.
2 yards, *or* 6 ft.... ... ... 1 fathom, f.
5½ yards, *or* 16½ ft. ... ... 1 roll, pole or perch.
7 yards, a perch Irish. ... ...
4 poles, *or* 22 yds. ... ... 1 land chain, 1 ch.
40 rods, *or* 10 ch. *or* 220 yds. ... ... 1 furlong, fur.
8 furlongs, *or* 80 ch. *or* 1760 yds. ... ... 1 mile, m.
3 miles, *or* 5280 yds... ... ... 1 league, l.
69½ miles, English statute ... ... 1 degree, d.
360 degrees the circumference of the globe.

A nautical mile, 6075.81 feet.

The earth's circumference is equal to 131237500 feet, or 24855 miles, very nearly.

NOTE.—An inch is divided into 8 parts, by joiners, engineers, and mechanics; into 10 parts by surveyors, architects, and others; and 12 parts when used duodecimally. The chain used for measuring land is 66 feet, and it is divided into 100 links, each of them 7.92 inches.

Comparison of Foreign Measures of Length with England.

	Yards.		Yards.
Mile of England	1760	Small League in Germany ...	5866
„ Scotland	1984	„ Spain	5028
„ Ireland	2200	„ Poland...	4400
Small League in France... ...	2933	„ Hungary	8800
„ Mean ditto ...	3666	„ Ancient Greece	1624
„ Large ditto ...	4400	„ Sweden and Denmark .	7233
„ Italy...	1467	„ Russia (verst)	1167

THE DISTANCES OF THE COMMERCIAL CITIES IN THE WORLD FROM LONDON.

	Distance from London		Distance from London.
Algiers ...	...*Africa* 900	Lisbon ...	...*Portugal.* ... 720
Amsterdam	...*Holland*... ... 180	Madrid ...	...*Spain* 660
Antwerp...	...*Netherlands* ... 212	Mecca ...	...*Arabia*... ...1860
Baltimore...	...*United States*..2200	Mexico ...	...*North America*3240
Berlin ...	...*Prussia*... ... 360	Milan ...	...*Italy* 380
Berne ...	...*Switzerland* ... 300	Morocco...	...*Africa*... ...1200
Boulogne .	...*France* 101	Munich ..	...*Germany* ... 310
Brussels ...	...*Belgium*... ... 209	Naples ...	...*Italy* 660
Bogota ...	...*South America*3240	New York	...*United States*.2100
Boston ...	...*United States*. 2000	Paris... ...	...*France*... ... 227
Buenos Ayres	...*South America*4620	Pekin... ...	...*China* 3480
Cairo ...	...*Egypt* 1320	Philadelphia	...*United States*.2170
Calais ...	...*France* 95	Quebec ...	...*Canada*... ...1920
Calcutta ...	...*East Indies* ...3060	Rio Janeiro	...*South America*4080
Cashmere..	...*Asia* 2220	Rome... ...	...*Italy* 600
Constantinople	.*Turkey* 900	St. Petersburgh.	*Russia*... ... 990
Copenhagen	...*Denmark* ... 480	Samarcand	...*Tartary*. ...1860
Delhi ...	...*East Indies* ...2580	Siam	...*East Indies*...3630
Dieppe ...	...*France* 127	Stockholm.	...*Sweden* 720
Dresden ...	...*Saxony* 360	Stutgard...	...*Germany*. ... 270
Florence...	...*Italy* 480	Timbuctoo.	...*Africa*... ...2220
Genoa ...	...*Italy* 420	Tonquin ...	...*China*... ...3540
Hamburgh	...*Hanseatic City* 320	Tunis ...	...*Africa*... ... 900
Hanover...	...*Germany*. ... 300	Turin ...	...*Sardinia*. ... 390
Havre ...	...*France* 160	Venice ...	...*Italy* 430
Ispahan ...	...*Persia* 1690	Vienna ...	...*Austria*.. ... 420
Jedo	...*Japan* 4200	Warsaw ...	...*Poland*.. ... 450
Lima	...*South America*3900	Washington	...*United States*..2280

RULE.—Miles multiplied by 8 are furlongs; furlongs multiplied by 40 are poles; poles multiplied by 16½ are feet (English); poles multiplied by 21 are feet (Irish); feet multiplied by 12 are inches; inches multiplied by 3 are barleycorns.

EXAMPLES.

60.—In 273 miles how many inches?—*Ans.* 17297280 inches.
61.—In 17297280 inches how many miles?—*Ans.* 273 English.
62.—In 273 Irish miles how many inches?—*Ans.* 22014720 inches.
63.—How many miles are there in 22014720 inches?—*Ans.* 273 Irish.
64.—In 45 m. 3 fur. 4 yds. 3 ft. how many feet?—*Ans.* 304935 ft. Irish.
65.—How many miles are there in 304935 feet Irish?—*Ans.* 45 miles, 3 furlongs, 4 yards, 3 feet.

QUERIES.

How many yards in an English mile?
How many in a Scotch mile?
How many in an Irish mile?
Tell me the yards in a league in France, in Germany, in Spain, Poland, Hungary, Greece, Sweden, Denmark and Russia?

CLOTH MEASURE.

Hollands are measured by the ell (English), and tapestry by the ell (Flemish). The weaving of muslin is paid for by the ell (English), but bought and sold by the yard. Linens, woollens, wrought silks, and tape, are sold by the yard.

$2\frac{1}{4}$ inches	.....make.....	1 nail.
4 nails	.....	1 quarter.
4 quarters	.....	1 yard.
3 quarters	.....	1 Flemish ell.
5 quarters	.....	1 English ell.
$4\frac{1}{8}$ quarters (37 inches)	.....	1 Scotch ell.
6 quarters	.....	1 French ell.

Rule.—Yards × by 4..... are quarters.
Quarters × by 4..... are nails.
Nails × by $2\frac{1}{4}$ ..... are inches.
Nails × by 4..... are quarters.
Quarters × by 4..... are yards.

Ells (French) × by 3, and ÷ by 2 are yards.
Yards — × by 2, and ÷ by 3 are ells—French.
Yards — × by 4, and ÷ by 3 are ells—Flemish.
Yards — × by 4, and ÷ by 5 are ells—English.
Ells (French) × by 6, and ÷ by 5 are ells—English.
Ells (English) × by 5, and ÷ by 4 are yards.
Ells (Flemish) × by 3, and ÷ by 4 are yards.
Ells (French) × by 2, are ells—Flemish.
Ells (English) × by 5, and ÷ by 6 are ells—French.
Ells (English) × by 5, and ÷ by 3 are ells—Flemish.
Ells (Flemish) × by 3, and ÷ by 5 are ells—English.
Ells (Flemish) × by 2, are French ells.

RULE.—Yards multiplied by 4 are quarters; quarters multiplied by 4 are nails; yards multiplied by 3 are quarters Flemish; yards multiplied by 5 are quarters English; yards multiplied by 6 are quarters French.

EXAMPLES.

66.—How many nails in 40 yards?—*Ans.* 640 nails.
67.—In 640 nails how many yards?—*Ans.* 40 yards.
68.—In 20 yds. 3 qrs. 1 nail how many nails?—*Ans.* 333 nails.
69.—How many yards are in 333 nails?—*Ans.* 20 yds. 3 qrs. 1 nail.
70.—How many quarters in 30 yds. 3 qrs.?—*Ans.* 123 qrs.
71.—In 123 qrs. how many yards?—*Ans.* 30 yds. 3 qrs.
72.—How many quarters in 40 ells English?—*Ans.* 200 qrs.
73.—In 200 quarters how many ells English?—*Ans.* 40 ells English.
74.—In 784 yds. 2 qrs. 3 nails, how many nails?—*Ans.* 12655 nails.
75.—How many yards in 2384 nails?—*Ans.* 149 yards.
76.—In 1000 yards how many quarters?—*Ans.* 4000 qrs.
77.—How many yards in 28964 nails?—*Ans.* 1810 yds. 1 qr.

QUERIES.

How are yards brought to ells?
How are nails brought to yards?
How are ells English brought to ells Flemish?
How are ells Flemish brought to ells English?
Bring ells English to yards.
Ells Flemish to French ells?

YARN MEASURE.

COTTON YARN.

Inches.	Threads	Skeins, Leas or Raps.	Hanks, or 560 yards.	Spindle.
54	= 1	....	....	....
4320	80	= 1	....	....
302.0	560	7	= 1	....
544320	10080	126	18	= 1

WORSTED YARN.

Inches.	Threads	Leas or Raps.	Hank, or 560 yards.
36	= 1	....	....
2860	80	= 1	....
20160	560	7	= 1
....	....	....	....

LINT OR LINEN YARN.

Inches.	Yards.	Threads	Leas, Cuts, or Raps.	Beers.	Slips.	Hasps.	Spindles.	Bundle.
36	= 1	...	...	...	...	...	...	...
90	$2\frac{1}{2}$	= 1	...	...	...	...	...	...
10800	300	120	= 1	...	...	...	...	...
21600	600	240	2	= 1	...	...	...	...
108000	3000	1200	10	5	= 1	...	...	...
129600	3600	1440	12	5	$1\frac{1}{5}$	= 1	...	...
518400	14400	5760	48	24	$4\frac{4}{5}$	4	= 1	...
2160000	60000	24000	200	100	20	$16\frac{2}{3}$	$4\frac{1}{6}$	= 1

NOTE.—Ermland yarn is 85½ *in.* to one thread, and 40 *thd.* to one lea; Hamburgh yarn is 80 *in.* to one thread, and 90 *thd.* to one lea. Also, the cotton-reel is 54 *in.* in circuit; the linen-reel is 90 *in.* in circuit; the worsted-reel is 20 *in.* in the circuit; the ounce-thread reel is 30 *in.* in circuit; and a hank of this yarn is 30 *thd.*

IMPERIAL LIQUID MEASURE,

Established by Act of Parliament as a General Measure of Capacity for Liquid and Dry Articles.

The Imperial Gallon is the legal standard for regulating all other measures. It must contain 10 lbs. Avoirdupois Weight of pure water, and at the temperature of 62 deg. of Fahrenheit's thermometer. This quantity measures 277¼ cubic inches, very nearly; being about one-fifth greater than the old Wine Measure, one thirty-second greater than the old Dry Measure, and one-sixtieth less than the old Ale Measure.

IN WINE OR SPIRIT MEASURE.

2 pints* make	... ...	1 quart.
4 quarts	... ...	1 gallon.†
63 gallons	... ...	1 hogshead.‡
84 gallons	... ...	1 puncheon.
2 hhds. or 126 gals.	... ...	1 pipe or butt.
4 hhds. or 252 gals.	... ...	1 tun.

IN ALE, BEER, AND PORTER MEASURE.

2 pints make	... ...	1 quart.
4 quarts	....	1 gallon.
9 gallons	... ...	1 firkin.
2 firkins, or 18 gallons	... ...	1 kilderkin.
2 kilderkins, or 36 gallons	... ...	1 barrel.
3 kilderkins, or 54 gallons	... ...	1 hogshead.
2 hogsheads, or 108 gallons	... ...	1 butt.

* A quarter of a pint is called a gill, or noggin; but in some parts half a pint is termed a gill, and a quarter pint is termed a jack.

† The old ale gallon contained 282 cubic inches.

‡ The quantity of a hogshead or pipe is various in different sorts of wine: thus of—

Claret	63 gallons are	1 hogshead.
Madeira	110 gallons ..	1 pipe.
Vidonia	120 gallons ..	1 pipe.
Sherry	130 gallons ..	1 pipe.
Port	138 gallons ..	1 pipe.
Lisbon, Bucellas	140 gallons ..	1 pipe.

But these measures are not uniformly adhered to; and the casks are usually charged by the number of gallons they contain.

NEW TABLE OF LIQUID MEASURE.

	TUN.	PIPE.	PUN.	HHD.	TIER.	GAL.	POTL.	QTS.	PTS.
1 tun	1	2	3	4	6	252	504	1008	2016
1 pipe	$\frac{1}{2}$	1	...	...	...	...	...	...	...
1 pun.	$\frac{2}{3}$	$\frac{2}{3}$	1	...	...	...	...	...	...
1 hhd.	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	1	...	...	...	...	...
1 tierce	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	1	...	...	...	...
36 gals.	$\frac{1}{7}$	$\frac{1}{4}$	$\frac{3}{7}$	$\frac{4}{7}$	$\frac{6}{7}$	...	...	...	...
28 ,,	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{4}{9}$	$\frac{2}{3}$	...	...	...	...
21 ,,	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{2}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	...	...	...	...
18 ,,	$\frac{1}{14}$	$\frac{1}{7}$	$\frac{3}{14}$	$\frac{2}{7}$	$\frac{3}{7}$	...	...	...	...
14 ,,	$\frac{1}{18}$	$\frac{1}{9}$	$\frac{1}{6}$	$\frac{2}{9}$	$\frac{1}{3}$	...	...	...	...
12 ,,	$\frac{1}{21}$	$\frac{1}{12}$	$\frac{1}{7}$	$\frac{4}{21}$	$\frac{2}{7}$	...	...	...	...
9 ,,	$\frac{1}{28}$	$\frac{1}{14}$	$\frac{2}{28}$	$\frac{1}{7}$	$\frac{2}{14}$	...	...	...	...
7 ,,	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{1}{6}$	...	...	...	...
6 ,,	$\frac{1}{42}$	$\frac{1}{21}$	$\frac{1}{14}$	$\frac{2}{21}$	$\frac{1}{7}$	...	...	...	...
4 ,,	$\frac{1}{63}$	$\frac{2}{63}$	$\frac{1}{21}$	$\frac{4}{63}$	$\frac{2}{21}$	...	...	...	...
3 ,,	$\frac{1}{84}$	$\frac{1}{42}$	$\frac{1}{28}$	$\frac{1}{21}$	$\frac{1}{14}$	...	...	...	...
2 ,,	$\frac{1}{126}$	$\frac{1}{63}$	$\frac{1}{42}$	$\frac{2}{63}$	$\frac{1}{21}$	...	...	...	...
1 ,,	$\frac{1}{252}$	$\frac{1}{126}$	$\frac{1}{84}$	$\frac{1}{63}$	$\frac{1}{42}$	...	...	...	...
1 pottle	$\frac{1}{504}$	$\frac{1}{252}$	$\frac{1}{168}$	$\frac{1}{126}$	$\frac{1}{84}$	$\frac{1}{2}$	...	...	...
1 quart	$\frac{1}{1008}$	$\frac{1}{504}$	$\frac{1}{336}$	$\frac{1}{255}$	$\frac{1}{168}$	$\frac{1}{4}$	$\frac{1}{2}$	...	...
1 pint	$\frac{1}{2016}$	$\frac{1}{1008}$	$\frac{1}{672}$	$\frac{1}{504}$	$\frac{1}{336}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	...
$\frac{1}{2}$ pint	$\frac{1}{4032}$	$\frac{1}{2016}$	$\frac{1}{1344}$	$\frac{1}{1008}$	$\frac{1}{672}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$
1 nog.	$\frac{1}{8064}$	$\frac{1}{4032}$	$\frac{1}{2688}$	$\frac{1}{2016}$	$\frac{1}{1344}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$

RULE.—Tuns multiplied by 4 are hogsheads; hogsheads multipled by 63 are gallons; gallons multiplied by 4 are quarts; quarts multiplied by 2 are pints; pints divided by 2 are quarts; quarts divided by 4 are gallons; gallons by divided 63 are hogsheads; hogsheads divided by 4 are tuns.

EXAMPLES.

78.—In 20 tuns 3 hhds. 50 gallons how many gallons?—*Ans.* 5279 gallons.
79.—In 5279 gallons how many tuns?—*Ans.* 20 tuns 3 hhds. 50 gals.
80.—How many pints are there in 3 hhds. 20 gals. 1 qt.?—*Ans.* 1674 pts.
81.—In 1674 pints how many hogsheads?—*Ans.* 3 hhds 20 gals. 1 qt.
82.—In 21 gallons, 2 quarts, 1 pint how many pints?—*Ans.* 173 pints.
83.—In 173 pints how many gallons?—*Ans.* 21 gallons, 2 quarts, 1 pint.

QUERIES.

How are tuns brought to gallons?
How are tuns brought to pints?
How are pints brought to hogsheads?
How are hogsheads brought to tuns?

DRY MEASURE.

2 pints	... make ...	1 quart.		8 bushels	... make ...	1 quarter.
4 quarts	... ...	1 gallon.		4 quarters	... ...	1 chaldron.
2 gallons	... ...	1 peck.		10 quarters	... ...	1 last.
4 pecks	... ...	1 bushel.*				

The old dry gallon contained 268 four-fifths cubic inches.
Coals are now sold by weight only.

EXAMPLES.

84.—In 24 gals. 2 qts. 1 pt. how many pints?—*Ans.* 197 pints.
85.—In 4687 pints how many gallons?—*Ans.* 585 gals. 3 qts. 1 pt.
86.—How many quarts in 1352 quarters 5 bushels 3 pecks 7 quarts?—*Ans.* 346303 quarts.
87.—In 30720 quarts of corn how many quarters?—*Ans.* 120 qrs.
88.—In 264397 pecks how many chaldrons?—*Ans.* 2065 chal. 2 qrs. 3 bush. 1 peck.
89.—In 4436721 pints how many quarters?—*Ans.* 8665 qrs. 3 bush. 1 pint.

FRENCH WEIGHTS AND MEASURES.

WEIGHTS.

					Troy Weight.			
					lbs.	oz.	dwts.	grs.
Milligramme	... ...	·0154	English grains.					
Centigramme	... ...	·1544	„	„				
Decigramme	... ...	1·5444	„	„				
Gramme†	... ...	15·4440	„	„				
Decagramme	... ...	154·4402	„	„	= 0	0	6	10·44
Hecatogramme	... ...	1544·4023	„	„	= 0	3	4	8·40
Kilogramme	... ...	15444·0234	„	„	= 2	8	3	12·02
Myriogramme	.. ...	154440·2344	„	„	=26	9	15	0·23

A kilogramme = 2 lbs. 3 oz. 5 drs. avoirdupois very nearly.

LINEAL MEASURE.

					m.	fur.	yds.	ft.	in.
Millimetre	... ...	·039371	English inches.						
Centimetre	... ...	·39371	... „	„					
Decimetre	... ...	3·9371	... „	„					
Metre	... ...	39·371	... „	„	= 0	0	1	0	3·371
Decametre	...	393·71	... ... „	„	= 0	0	10	2	9·71
Hecatometre	...	3937·1	... ... „	„	= 0	0	109	1	1·1
Kilometre	...	39371·	... ... „	„	= 0	4	213	1	11
Myriometre	...	393710·	... ... „	„	= 6	1	156	1	2

* A strike is properly 2 bushels; but in some districts these terms are reversed, or used one for another.

† The weight of a cubic centimetre of distilled water

SUPERFICIAL MEASURE.

				a.	r.	p.
Are*	119·6046	square yards	=	0	0	3·95
Decare	1196·046	„ „	=	0	0	39·538
Hecatare	11960·46	„ „	=	2	1	35·38

SOLID MEASURE.

Decistere	3·5317	English cubic feet.	
Stere†	35·317	„	„
Decastere	353·17	„	„

MEASURES OF CAPACITY.

						Imp. Measure.	
						gals.	pt.
Millilitre	·061028	English cubic inches					
Centilitre	·61028	„	„	„			
Decilitre	6·1028...	„	„	„			
Litre‡	...61·028 ...	„	„	„	=	0	1·76
Decalitre	610·28 ...	„	„	„	=	2	1·60
Hecatolitre	6102·8 ...	„	„	„	=	22	0·08
Kilolitre	61028 ...	„	„	„	=	220	0·80
Myriolitre	...610280 ...	„	„	„	=	2201	0

TIME.

60 seconds (*sec.*) ... ... make	1 minute, *min.*
60 minutes, or 3600 seconds	1 hour, *hr.*
24 hours, or 1440 minutes	1 day, *d.*
7 days, or 168 hours	1 week, *wk.*
4 weeks, or 28 days	1 lunar month, *m.*
28, 29, 30, or 31 days	1 calendar month.
52 wks., 1 day, 6 hrs.; or 365 days, 6 hrs.; or 8766 min.	1 Julian year, *yr.*
365 days, 5 hours, 48 minutes, 51½ seconds	1 solar year.
100 years	1 century.
12 calendar or 13 lunar months	1 year.

QUARTERLY TERMS.

In England.	*In Scotland.*
Lady Day, March 25th.	Candlemas, February 2nd.
Midsummer, June 24th.	Whitsuntide, May 15th.
Michaelmas, Sept. 29th.	Lammas, August 1st.
Christmas, December 25th.	Martinmas, November 11th.

* A square decametre. † A cubic metre. ‡ A cubic decametre.

To know the days in each month, observe—

The days are thirty in September,
April, June, and November;
Twenty-eight in February alone;
In each other thirty-one;
But in every leap year* you'll find
February counts twenty-nine.

GEOMETRICAL MEASURE.

60 seconds ″	make	1 minute. ′
60 minutes		1 degree. °
90 degrees		1 quadrant.
360 degrees, or 4 quadrants...		1 circle.

Many highly important calculations in the mathematical sciences are founded on this division of the circle.

In geography, a degree of latitude (or of longitude on the equator), measures 69·07, or nearly $69\frac{1}{10}$ British miles.

A geographical or nautical mile, is one-sixtieth part, or a minute of a degree; six geographical miles are nearly equal to seven English miles.

In astronomy, the great circle of the Ecliptic (or the Zodiac) is divided into twelve signs, each containing 30 degrees.

THE SIX NORTHERN SIGNS.

SPRING SIGNS.	SUMMER SIGNS.
The Sun enters,	*The Sun enters,*
♈ *Aries*, the Ram, March 21.	♋ *Cancer*, the Crab, June 21.
♉ *Taurus*, the Bull, April 20.	♌ *Leo*, the Lion, July 23.
♊ *Gemini*, the Twins, May 21.	♍ *Virgo*, the Virgin, August 23.

THE SIX SOUTHERN SIGNS.

AUTUMNAL SIGNS.	WINTER SIGNS.
The Sun enters,	*The Sun enters,*
♎ *Libra*, the Balance, Sept. 23.	♑ *Capricornus*, the Goat, Dec. 21.
♏ *Scorpio*, the Scorpion, Oct. 23.	♒ *Aquarius*, the Water-bearer, January 20.
♐ *Sagittarius*, the Archer, November 21.	♓ *Pisces*, the Fishes, Feb. 18.

* The leap year is found by dividing by 4: if even, it is leap year if odd, so many after leap year.

"The ram, the bull, the heavenly twins,
And next the crab the lion shines,
The virgin and the scales,
The scorpion, archer, and sea-goat,
The man that holds the water-pot,
And fish with glittering tails."

The progress of the sun through these signs causes the variation in the length of days, and the consequent vicissitudes of the seasons. Spring commences at the Vernal Equinox (March 21), when the sun enters Aries; Summer, at the Summer Solstice (June 21), when he enters Cancer; Autumn, at the Autumnal Equinox (September 23), when he enters Libra; and Winter, at the Winter Solstice (December 21), when he enters Capricorn.

The longest day is that of the Summer Solstice, and the shortest, that of the Winter Solstice. At the equinoxes, the day and night are everywhere equal.

☉ *Sol*, the Sun, the centre of the solar system.
☽ *Luna*, the Moon, a secondary planet, attending the Earth.

WANDERING STARS, CALLED PLANETS.

☿ Mercury. ♀ Venus. ⊕ The Earth. ♂ Mars.
♃ Jupiter. ♄ Saturn. ♅ Herschel.

EXAMPLES.

90.—In 72015 hours how many weeks?—*Ans.* 428 weeks, 4 days, 15 hrs.
91.—How many hours are there in 428 weeks, 4 days, 15 hours?—*Ans.* 72015 hours.
92.—In 1440 minutes how many seconds?—*Ans.* 86400 seconds.
93.—How many minutes are there in 86400 seconds?—*Ans.* 1440 minutes.
94.—If a clock strikes 156 times a day, how many strokes will it strike in 6 years?—*Ans.* 341640.
95.—How many minutes has a boy lived who is 10 years and 6 weeks old? *Ans.* 5316480 minutes.
96.—How many years and days is it since the Battle of Waterloo, which was gained on the 18th of June, 1815, it being now the 1st of May, 1853?—*Ans.* 37 years, 316 days.
97.—Joseph was born A. M. 2274, he died A.M. 2384; what age was he when he died, and how many minutes did he live, reckoning 365¼ days to the year?—*Ans.* 110 years; 10335600 minutes.
98.—How many minutes is it since the birth of our blessed Redeemer, reckoning as above—being now the year 1853?—*Ans.* 974603880 minutes.

QUERIES.

How many minutes in an hour? How many hours in the day? How many days in a week? How many weeks in a year?
How would you bring years to minutes, and days to years?
How many quarters in the year, and what are the signs for each quarter?

RULE.—For 4 in farthings carry 1 to the pence; for 12 in pence carry 1 to the shillings; for 20 in shillings carry 1 to the pounds; and carry 1 for every 10 in the pounds, as in simple addition.

Reason.—4 farthings make 1d. in the place of pence; 12 pence make 1s. in the line of shillings; and 20s. make £1 in the place of pounds; and add the pounds as whole numbers.

NEW TABLE OF MONEY.

	of £1.	of 10s.	of 6s.8d.	of 5s.	of 3s.4d.	of 2s.6d.	of 2s.	of 1s.8d.	of 1s.6d.	of 10d.
10s. 0d.	1/2	...	...	...	...	...	...	...	...	...
6 8	1/3	...	...	...	...	...	...	...	...	...
5 0	1/4	1/2	...	...	...	...	...	...	...	...
3 4	1/6	1/3	1/2	...	...	...	...	...	...	...
2 6	1/8	1/4	...	1/2	...	...	...	...	...	...
2 0	1/10	1/5	...	...	...	...	...	...	...	...
1 8	1/12	1/6	1/4	1/3	1/2	...	...	...	...	...
1 4	1/15	...	1/5	...	...	...	...	...	...	...
1 3	1/16	1/8	...	1/4	...	1/2	...	...	...	...
1 0	1/20	1/10	...	1/5	...	...	1/2	...	...	...
0 10	1/24	1/12	1/8	1/6	1/4	1/3	...	1/2	...	...
0 8	1/30	1/15	1/10	...	1/6	...	1/3	...	...	...
0 7½	1/32	1/16	...	1/8	...	1/4	...	...	...	...
0 6	1/40	1/20	...	1/10	...	1/5	1/4	...	1/2	...
0 5	1/48	1/24	1/16	1/12	1/8	1/6	...	1/4	...	1/2
0 4	1/60	1/30	1/20	1/15	1/10	...	1/6	1/6	1/8	...
0 3	1/80	1/40	...	1/20	...	1/10	1/8	...	1/4	...
0 2	1/120	1/60	1/40	1/30	1/20	1/15	1/12	1/10	1/8	1/5
0 1	1/240	1/120	1/80	1/60	1/40	1/30	1/24	1/20	1/12	1/10
0 0½	1/480	1/240	1/160	1/120	1/80	1/60	1/48	1/40	1/24	1/20
0 0¼	1/960	1/480	1/320	1/240	1/160	1/120	1/96	1/80	1/48	1/40

EXAMPLES.

1.	£1479	14s.	6½d.	2.	£3768	11s.	8½d.
	7168	17	4¾		1313	16	5¾
	3133	14	11¼		1927	11	10¼
	3171	19	10¾		3168	16	5½
Ans.	14954	6	9¼	*Ans.*	10178	16	6
	13474	12	2¾		6410	4	9½
Proof.	14954	6	9¼	*Proof.*	10178	16	6

3.	£.	s.	d.
	16437	19	11¾
	94321	10	5½
	61427	17	8¼
	58654	12	11¼
Ans.	230842	1	1

4.	£.	s.	d.
	1523	17	2½
	3456	18	7¼
	6543	12	1¾
	1234	15	6¼
Ans.	12759	3	5¾

5.	£.	s.	d.
	57	16	3½
	42	13	9½
	33	17	6¼
	53	18	9¼
	76	16	10¾
	84	17	6½

6.	£.	s.	d.
	97	18	3½
	84	16	9¼
	73	17	5¼
	64	13	7¾
	53	18	6¼
	63	19	7¾

7.	£.	s.	d.
	56	16	9½
	47	13	3¾
	83	13	9¼
	62	17	5½
	48	13	9¼
	65	15	10½

As we have in page 26 recommended a system of simple addition for practice on the blackboard, (in order to save trouble to teachers in large schools), by which they can see at one view the answer of any question without the trouble of adding the sum over again,—so, on the same principle, we here offer a similar plan in addition of money, which may be made applicable in all cases in compound addition, no matter what the denomination may be.

RULE.—In arranging the question put the first line at pleasure, but have the second line to correspond with the first, so that in the pence the two figures in units' place make 12. In the line of shillings, the next two figures to make exactly 20, with the carried figures from the pence, and in the line of pounds, that each two figures make 10. The key line may be set down at top, bottom, or in the middle of the question, which will be the answer without the trouble of adding. This will be a great saving of time and labour to the teacher.

8.	£.	s.	d.	
	6	7	9	
	3	12	3	
	7	6	5	
	2	13	7	
	6	9	8	
	3	10	4	
	5	9	2	K. L.
Ans.	35	9	2	

9.	£.	s.	d.
	13	11	11
	8	7	6
	1	12	6
	3	13	7
	6	6	5
	9	12	10
	0	7	2
Ans.	43	11	11

10.	£.	s.	d.	
K. L.	24	7	6	
	75	12	6	
	53	18	9	
	46	1	3	
	34	17	6	K. L.
	56	16	4	
	43	3	8	
Ans.	334	17	6	

10.	£.	s.	d.		11.	£.	s.	d.		12.	£.	s.	d.	
	127	16	9			721	1	9			673	2	9	
	872	3	3			278	18	3			326	17	3	
	674	9	1			613	7	1			888	8	8	K. L.
	325	10	11			386	12	11			753	6	2	
	190	19	9	K. L.		119	9	7			246	13	10	
	473	7	10			880	10	5			632	9	5	
	526	12	2			132	17	4			367	10	7	
	214	3	2			867	2	8			865	2	8	
	785	16	10			999	0	0	K. L.		134	17	4	
Ans.	4190	19	9		*Ans.*	4999	0	0		*Ans.*	4888	8	8	

APPLICATION.

8.—William Russell, Esq., of Brancepeth Castle, is going to the continent, and wishing to have his bills settled, calls on his steward, who lays the following accounts before him:—The draper's account, £123 19s.; the brewer's ditto, £41 10s.; the butcher's, £212 12s. 6d.; the baker's, £24 0s. 6d.; the chandler's, £13 8s.; the architect's, £137 9s. 9d.; the doctor's, £74 13s. 6d.; the coach builder's, £214 16s. 6d.; the wine merchant's, £62 12s.; the confectioner's, £16 2s.; rent, £86 2s.; servants' wages, £46 1s.; he wants also to defray the expenses of his journey, £330 12s. 1d.; how much must he draw from his banker to settle the whole?—*Ans.* £1383 18s. 10d.

9.—I owe Messrs. J. Potter and Co., Manchester, as follows, viz:—For tea, £13 10s.; cheese, £17 13s. 5d.; cotton, £208 17s.; chintz, £86 0s. 9d.; a former account, £300; factorage, £15 17s. 3½d.; broad cloth, £30 10s. 4½d.; what do I owe them in all?—*Ans.* £672 8s. 10½d.

10.—Mr. Moore, lace merchant, purchased goods to the amount of £1468 16s. 7d.; he paid freight, £27 7s. 6d.; other charges, £23 14s. 7½d.; he sold them immediately for £1668 17s. 6½d.; what sum did he gain?—*Ans.* £148 18s. 10½d.

ADDITION OF TROY WEIGHT.

RULE.—For 24 grains, carry 1 to the pennyweights; for 20 pennyweights, carry 1 to the ounces; for 12 ounces, carry 1 to the lbs; and carry 1 for every 10 in the lbs., as in simple addition.

EXAMPLES.

	lb.	oz.	dwts.	gr.		lb.	oz.	dwts.	gr.		lb.	oz.	dwts.	gr.
13.	4712	11	19	17	14.	163	10	15	13	15.	4763	9	13	17
	3714	10	17	15		971	11	14	16		5236	11	19	6
	9713	11	13	17		316	10	13	17		4273	7	13	13
	3174	10	17	12		941	10	11	13		3412	5	12	14

APPLICATION.

14.—Bought 3 dozen of silver spoons, weighing 5 lb. 9 oz. 8 dwt.; a teapot, weighing 3 lb. 2 oz. 16 dwts. 16 grs.; two salvers, weighing 4lb. 6 oz. 17 dwts.; a dozen silver forks, weighing 1 lb. 8 oz. 19 dwts. 22 grs.; what was the weight of all these articles?—*Ans.* 15 lb. 4 oz. 1 dwt. 14 grs.

15.—In a service of plate there were 20 dishes, weighing 203 oz. 8 dwt.; 36 plates, weighing 408 oz. 9 dwts.; 5 dozen spoons, weighing 112 oz. 8 dwts.; 12 salts, weighing 71 oz. 7 dwts.; knives and forks, weighing 73 oz. 5 dwts.; two large cups and a tankard, weighing 121 oz. 7 dwts.; with sundry articles, weighing 105 oz. 5 dwts.; what was the weight of the whole?—*Ans.* 91 lb. 5 oz. 1 dwt.

QUERIES.

How do you bring grains to lbs.?
Tell how you bring lbs. to grains?
How do you prove addition of troy weight?

ADDITION OF AVOIRDUPOIS WEIGHT.

RULE.—For 16 drachms, carry 1 to the ounces; for 16 ounces, carry 1 to the lbs.; for 28 lbs. carry 1 to the quarters; for 4 quarters carry 1 to the cwts.; for 20 cwts. carry 1 to the tuns; and the tuns as in simple addition.

EXAMPLES.

	tuns.	cwt.	qr.	lb.		cwt.	qr.	lb.		lb.	oz.	dr.
16.	3746	17	3	14	17.	134	3	17	18.	1376	11	15
	1373	14	1	17		131	2	18		1314	10	11
	1468	13	3	15		147	1	17		3715	11	14
	1313	11	1	19		914	2	17		1123	10	14

APPLICATION.

19.—Bought 5 bags of hops: the first weighed 2 cwt. 3 qrs. 13 lb.; the second, 2 cwt. 2 qrs. 11lb.; the third, 2 cwt. 3 qrs. 5 lb.; the fourth, 2 cwt. 3 qrs. 12 lb.; the fifth, 2 cwt. 3 qrs. 15 lb.; what was the weight of the whole?—*Ans.* 14 cwt.

20.—A grocer bought 6 hhds. of sugar; the first weighed 5 cwt. 3 qrs. 27 lb.; the second, 4 cwt. 1 qr. 19 lb.; the third, 6 cwt. 2 qrs. 20 lb.; the fourth, 3 cwt. 3 qrs. 22 lb.; the fifth, 7 cwt. 1 qr. 11 lb.; and the sixth, 4 cwt. 3 qrs. 17 lb.; what was the weight of all?—*Ans.* 33 cwt. 1 qr. 4 lb.

APOTHECARIES' OR CHEMISTS' WEIGHTS.

RULE.—For 20 in grains, carry 1 to the scruples; for 3 in scruples, carry 1 to the drachms; for 8 in drachms, carry 1 to the ounces; for 12 in ounces, carry 1 to the lbs.; and the lbs. as in simple addition.

EXAMPLES.

	lb.	oz.	dr.	sc.
19.	174	10	7	1
	19	11	5	1
	11	10	6	2
	9	6	1	1
	4	5	4	1
	14	1	3	2

	lb.	oz.	dr.	sc.
20.	11	11	5	1
	12	11	4	2
	17	10	5	1
	13	11	6	2
	17	10	5	1
	12	11	4	1

	lb.	oz.	dr.	sc.
21.	19	11	4	1
	14	10	5	2
	14	11	2	1
	14	10	7	1
	17	8	5	2
	18	4	4	1

APPLICATION.

24.—A chemist mixed 5 ingredients: the first weighed 13lb. 7 oz.; the second, 11 oz. 7 drs. 13 grs.; the third, 7 lb. 0 drs. 2 scrs.; the fourth, 11 lb. 3 drs. 1 scr.; the fifth, 15 lb. 5 oz. 7 grs.; what was the weight in all?—*Ans.* 48 lb. 3 drs. 1 scr.

QUERIES.

What do you carry from the grains?
What from the scruples?
What from the drachms?
What from the ounces?

LIQUID MEASURE.

RULE.—For 4 gills, carry 1 to the pints; for 2 pints carry 1 to the quarts; for 4 quarts carry 1 to the gallons; for 63 gallons, carry 1 to the hogsheads; for 4 hogsheads, carry 1 to the tuns; and the tuns as in simple addition.

EXAMPLES.

22.

hhd.	gal.	qt.	pt.	g.
31	57	2	1	1
19	17	3	1	3
17	39	2	1	1

23.

tun	hhd.	gal.	qt.	pt.	g.
37	3	27	2	1	1
17	2	60	1	1	3
39	1	58	1	1	2

24.

tun	hhd.	gal.	qt.	pt.	g.
39	2	14	1	1	3
40	1	57	3	1	2
99	1	53	2	1	3

APPLICATION.

28.—Bought 3 casks of Scotch malt: the first contained 44 gals. 8 qts. 1 pt. 3 gls.; the second contained 37 gals. 2 qts. 3 gls.; and the third measured 61 gals. 3 qts. 1 pt. 2 gills; what did the whole contain?—*Ans.* 144 gals. 2 qts.

NOTE.—One gallon of water, weighing 10lb. avoirdupois; a pint weighs 1¼lb.; and a bushel weighs 80lbs.

Repeat the rule for Liquid Measure.

DRY MEASURE.

RULE.—For 2 pints, carry 1 to the quarts; for 4 quarts, carry 1 to the gallons; for 2 gallons, carry 1 to the pecks; for 4 pecks, carry 1 to the bushels; and for eight bushels, carry one to the quarters; and the quarters as in simple addition.

	qrs.	b.	p.	g.
25.	37	1	3	3
	60	1	1	2
	14	0	2	3
	15	1	3	1

	b.	p.	g.	q.	pt.
26.	27	3	1	1	1
	26	2	0	0	0
	23	3	1	0	1
	13	3	1	1	1

	b.	p.	g.	q.	pt.
27.	31	2	1	1	0
	17	1	1	0	1
	20	1	1	1	0
	37	1	1	1	1

APPLICATION.

32.—Messrs. Losh, Wilson & Bell, of Newcastle, consign to their correspondent at Hamburgh, on the 1st January, 1853, 27 qrs. 6 b. 3 p. of wheat; on the 10th, 38 qrs. 4 b. 2 p.; on the 14th, 49 qrs. 6 b.; and on the 20th of the same month, 58 qrs. 7 b. 3 p.; how much did they export during the month?—*Ans.* 175 qrs. 1 b. 0 q.

Repeat the rule for Dry Measure.

CLOTH MEASURE.

RULE.—For every 4 nails, carry 1 to the quarters; for every 4 quarters, carry 1 to the yards; for every 5 quarters, carry 1 to the ells English; and for every 6 quarters, carry 1 to the ells French.

EXAMPLES.

	yds.	qr.	na.
28.	36	3	1
	37	1	1
	14	1	2
	15	2	3

	yds.	qr.	ns.
29.	374	1	2
	397	2	3
	462	3	1
	314	2	3

	e. E.	qr.	ns.
30.	421	2	2
	123	1	3
	210	2	3
	121	1	2

	e. F.	qr.	ns.
31.	312	2	2
	123	2	6
	314	1	2
	101	2	2

APPLICATION.

37.—A merchant received seven bales of linen: the first contained 72 yds. 1 qr. 2 na.; the second, 20 yds. 3 na.; the third, 100 yds.; the fourth, 36 yds. 3 na.; the fifth, 46 yds. 2 na.; the sixth, 71 yds. 2 qr. 1 na.; and the seventh, 46 yds. 1 qr. 2 na.; how many yards were there in all?—*Ans.* 392 yds. 3 qrs. 1 na.

Repeat the rule for Cloth Measure.

LONG MEASURE.

RULE.—For 3 barleycorns, carry 1 to the inches; for 12 inches, carry 1 to the feet; for 3 feet, carry one to the yards; for 5½ yards, carry 1 to the poles English; for 7 yards, carry 1 to the perches Irish; for 40 poles, carry 1 to the furlongs; for 8 furlongs, carry 1 to the miles.

EXAMPLES.

32.			33.			34.			35.			36.		
ml.	fur.	per.	ml.	fur.	per.	ml.	fur.	per.	ml.	fur.	yds.	f.	in.	b.
27	5	37	176	1	6	4	6	20	177	7	6	1	10	2
19	6	36	178	2	8	6	5	13	197	6	5	2	11	1
14	7	16	197	2	10	7	4	9	189	5	6	1	10	1
13	5	26	101	1	11	6	6	12	214	1	5	2	11	1

APPLICATION.

43.—James rode 35 mls. 2 fur. 34 per. on Monday; walked 24 mls. 6 fur. 25 per. 2 yds. on Tuesday; he rode, on Wednesday, 42 mls. 7 fur. 4 yds.; he walked, on Thursday, 15 mls. 4 fur. 38 per. 3 yds.; what distance did he travel in the four days?—*Ans.* 118 mls. 5 fur. 18 per. 3½ yds.

Repeat the rule for Long Measure.

SOLID MEASURE.

RULE.—For every 1728 solid inches, carry 1 to the feet; for every 27 solid feet, carry 1 to the yards; and for every 343 solid yards, carry 1 to the perches; and perches as in Simple Addition.

EXAMPLES.

37.				38.				39.			
per.	yds.	ft.	in.	per.	yds.	ft.	in.	per.	yds.	ft.	in.
374	130	14	150	176	126	23	1711	312	19	17	13
371	176	24	140	314	141	17	1214	164	26	23	14
914	68	23	13	431	19	24	1711	726	17	11	18

Repeat the rule for Solid Measure.

SQUARE OR LAND MEASURE.

RULE.—For every 144 square inches, carry 1 to the square feet; for every 9 square feet, carry 1 to the square yards; for every 49 square yards, carry 1 to the square perches or poles; for every 40 square perches or poles, carry 1 to the square acres, and the acres as in simple addition.

EXAMPLES.

40.

A.	r.	p.	yds.	ft.	in.
147	1	27	23	7	78
192	2	16	38	4	101
141	3	39	16	6	140
175	2	28	39	2	132

41.

A.	r.	p.	yds.	ft.	in.
2376	2	16	12	2	140
1242	3	32	17	7	111
1723	2	18	32	6	78
1115	3	19	39	8	132

Repeat the rule for Land or Square Measure.

ASTRONOMICAL TIME.

RULE.—For 60 seconds carry 1 to the minutes; for 60 minutes carry 1 to the hours; for 24 hours carry 1 to the days; for 7 days carry 1 to the weeks; for 4 weeks carry 1 to the months; for 12 months carry 1 to the years; and add the years as in simple addition.

EXAMPLES.

42.

w.	d.	h.	m.	s.
27	4	18	37	56
37	6	19	50	51
31	4	18	51	40

43.

degs.	′	″	‴	⁗
176	30	50	41	25
195	21	47	46	21
197	5	43	51	27

Repeat the rule for Astronomical Time.

COMPOUND SUBTRACTION.

COMPOUND SUBTRACTION teaches to find the difference between any two numbers of different denominations.

RULE.—Place the lesser number under the greater; begin at the right hand to subtract, and set down the remainder. The method of proof is the same as in simple subtraction.

EXAMPLES IN COIN.

	1.			2.			3.			4.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	12	13	$6\frac{1}{2}$	19	17	$4\frac{3}{4}$	135	17	$4\frac{1}{2}$	176	13	$10\frac{1}{2}$
Take	11	7	$4\frac{1}{4}$	11	10	$2\frac{1}{4}$	94	16	$1\frac{3}{4}$	57	18	$6\frac{3}{4}$

	5.			6.			7.			8.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	1000	0	2	100	13	4	136	17	$2\frac{1}{2}$	746	18	$3\frac{1}{4}$
Take	999	19	$11\frac{3}{4}$	99	16	$8\frac{1}{2}$	76	19	$9\frac{1}{2}$	76	19	$8\frac{3}{4}$

NOTE.—When the lower farthings are greater, borrow from 4, add the remainder to the lesser, and carry 1 to the pence; when the lower pence are higher, borrow from 12, adding the remainder to the lesser, and carry 1 to the shillings; when the shillings are lower, borrow from 20, adding the remainder to the lesser, carry 1 to the pounds, and the pounds as in simple subtraction.

TROY WEIGHT.

RULE.—When the lower grains are greater, borrow from 24, adding the remainder to the upper, and carry 1 to the dwts.; when the lower dwts. are greater borrow from 20, adding 1 to the ozs.; when the lower ozs. are greater, borrow from 12, and carry 1 to the lbs.; and substract the lbs. as in simple subtraction.

EXAMPLES.

	lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.
9. From	5	6	13	14	10.	374	11	12	6	11.	197	11	13	13
Take	3	4	6	8		279	10	17	8		178	10	17	10

Repeat the rule for subtracting Troy Weight.

AVOIRDUPOIS WEIGHT.

RULE.—When the lower drs. are greater, borrow from 16, and carry 1 to the ounces; when the lower ounces are greater, borrow from 16, and carry 1 to the lbs.; when the lower lbs. are greater, borrow from 28, and carry 1 to the qrs.; when the lower qrs. are greater, borrow from 4, and carry 1 to the cwts.; when the lower cwts. are greater, borrow from 20, and carry 1 to the tons—observing, in each case, to add the remainder to the upper number—and the tons as in simple subtraction.

EXAMPLES.

	12.						13.						14.					
	oz.	dr.	t.	cwt.	qrs.	lbs.	oz.	dr.	t.	cwt.	qrs.	lbs.	oz.	dr.
	6	14	16	16	2	14	13	13	23	17	3	19	12	12
	4	8	12	17	3	19	15	15	17	18	3	23	13	13

Repeat the rule for Avoirdupois Weight.

CHEMISTS' WEIGHT.

RULE.—When the lower grs. are greater, borrow from 20, and carry 1 to the scruples; when the lower scruples are greater, borrow from 3, carry 1 to the drachms; when the lower drachms are greater, borrow from 8, carry 1 to the ounces; when the lower ounces are greater, borrow from 12, and carry 1 to the lbs., and the lbs. as in simple subtraction.

EXAMPLES.

	15.					16.					17.				
	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.
From	19	8	7	2	19	24	6	5	1	16	27	5	6	1	17
Take	15	5	5	1	16	19	8	7	2	19	23	7	7	1	19

Repeat the rule for Chemists' Weight.

LIQUID MEASURE.

RULE.—When the lower pints are greater, borrow from 2, and carry 1 to the quarts; when the lower quarts are greater, borrow from 4, and carry 1 to the gallons; when the lower gallons are greater, borrow from 63, and carry 1 to the hogsheads; when the lower hogsheads are greater, borrow from 4, and carry 1 to the tuns; and the tuns as in simple subtraction.

EXAMPLES.

	18.					19.					20.				
	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.
From	140	3	56	2	1	163	2	56	1	0	176	3	23	1	1
Take	131	2	50	1	1	94	3	61	1	1	100	3	39	1	1

Repeat the rule for subtracting Liquids.

DRY MEASURE.

RULE.—For every 2 pints, carry 1 to the quarts; for every 4 quarts, carry 1 to the gallons; for every 2 gallons, carry 1 to the pecks; for every 4 pecks, carry 1 to the bushels: for every 8 bushels, carry 1 to the quarters; and the quarters as in simple subtraction.

EXAMPLES.

	21.						22.						23.					
	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.
From	136	7	3	1	3	1	204	6	2	0	2	0	311	6	3	1	3	1
Take	52	2	1	0	2	0	19	6	3	1	1	1	204	7	2	1	1	1

Repeat the rule in subtracting Dry Measure.

	5.			6.			7.			8.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	1000	0	2	100	13	4	136	17	$2\frac{1}{2}$	746	18	$3\frac{1}{4}$
Take	999	19	$11\frac{3}{4}$	99	16	$8\frac{1}{2}$	76	19	$9\frac{1}{2}$	76	19	$8\frac{3}{4}$

NOTE.—When the lower farthings are greater, borrow from 4, add the remainder to the lesser, and carry 1 to the pence; when the lower pence are higher, borrow from 12, adding the remainder to the lesser, and carry 1 to the shillings; when the shillings are lower, borrow from 20, adding the remainder to the lesser, carry 1 to the pounds, and the pounds as in simple subtraction.

TROY WEIGHT.

RULE.—When the lower grains are greater, borrow from 24, adding the remainder to the upper, and carry 1 to the dwts.; when the lower dwts. are greater borrow from 20, adding 1 to the ozs.; when the lower ozs. are greater, borrow from 12, and carry 1 to the lbs.; and substract the lbs. as in simple subtraction.

EXAMPLES.

	lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.
9. From	5	6	13	14	10.	374	11	12	6	11.	197	11	13	13
Take	3	4	6	8		279	10	17	8		178	10	17	10

Repeat the rule for subtracting Troy Weight.

AVOIRDUPOIS WEIGHT.

RULE.—When the lower drs. are greater, borrow from 16, and carry 1 to the ounces; when the lower ounces are greater, borrow from 16, and carry 1 to the lbs.; when the lower lbs. are greater, borrow from 28, and carry 1 to the qrs.; when the lower qrs. are greater, borrow from 4, and carry 1 to the cwts.; when the lower cwts. are greater, borrow from 20, and carry 1 to the tons—observing, in each case, to add the remainder to the upper number—and the tons as in simple subtraction.

EXAMPLES.

	12.					13.						14.					
	cwt.	qrs.	lbs.	oz.	dr.	t.	cwt.	qrs.	lbs.	oz.	dr.	t.	cwt.	qrs.	lbs.	oz.	dr.
From	16	3	14	6	14	16	16	2	14	13	13	23	17	3	19	12	12
Take	12	1	8	4	8	12	17	3	19	15	15	17	18	3	23	13	13

Repeat the rule for Avoirdupois Weight.

CHEMISTS' WEIGHT.

RULE.—When the lower grs. are greater, borrow from 20, and carry 1 to the scruples; when the lower scruples are greater, borrow from 3, carry 1 to the drachms; when the lower drachms are greater, borrow from 8, carry 1 to the ounces; when the lower ounces are greater, borrow from 12, and carry 1 to the lbs., and the lbs. as in simple subtraction.

EXAMPLES.

	15.					16.					17.				
	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.
From	19	8	7	2	19	24	6	5	1	16	27	5	6	1	17
Take	15	5	5	1	16	19	8	7	2	19	23	7	7	1	19

Repeat the rule for Chemists' Weight.

LIQUID MEASURE.

RULE.—When the lower pints are greater, borrow from 2, and carry 1 to the quarts; when the lower quarts are greater, borrow from 4, and carry 1 to the gallons; when the lower gallons are greater, borrow from 63, and carry 1 to the hogsheads; when the lower hogsheads are greater, borrow from 4, and carry 1 to the tuns; and the tuns as in simple subtraction.

EXAMPLES.

	18.					19.					20.				
	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.
From	140	3	56	2	1	163	2	56	1	0	176	3	23	1	1
Take	131	2	50	1	1	94	3	61	1	1	100	3	39	1	1

Repeat the rule for subtracting Liquids.

DRY MEASURE.

RULE.—For every 2 pints, carry 1 to the quarts; for every 4 quarts, carry 1 to the gallons; for every 2 gallons, carry 1 to the pecks; for every 4 pecks, carry 1 to the bushels: for every 8 bushels, carry 1 to the quarters; and the quarters as in simple subtraction.

EXAMPLES.

	21.						22.						23.					
	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.
From	136	7	3	1	3	1	204	6	2	0	2	0	311	6	3	1	3	1
Take	52	2	1	0	2	0	19	6	3	1	1	1	204	7	2	1	1	1

Repeat the rule in subtracting Dry Measure.

	5.			6.			7.			8.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	1000	0	2	100	13	4	136	17	$2\frac{1}{2}$	746	18	$3\frac{1}{4}$
Take	999	19	$11\frac{3}{4}$	99	16	$8\frac{1}{2}$	76	19	$9\frac{1}{2}$	76	19	$8\frac{3}{4}$

NOTE.—When the lower farthings are greater, borrow from 4, add the remainder to the lesser, and carry 1 to the pence; when the lower pence are higher, borrow from 12, adding the remainder to the lesser, and carry 1 to the shillings; when the shillings are lower, borrow from 20, adding the remainder to the lesser, carry 1 to the pounds, and the pounds as in simple subtraction.

TROY WEIGHT.

RULE.—When the lower grains are greater, borrow from 24, adding the remainder to the upper, and carry 1 to the dwts.; when the lower dwts. are greater borrow from 20, adding 1 to the ozs.; when the lower ozs. are greater, borrow from 12, and carry 1 to the lbs.; and substract the lbs. as in simple subtraction.

EXAMPLES.

	lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.
9. From	5	6	13	14	10.	374	11	12	6	11.	197	11	13	13
Take	3	4	6	8		279	10	17	8		178	10	17	10

Repeat the rule for subtracting Troy Weight.

AVOIRDUPOIS WEIGHT.

RULE.—When the lower drs. are greater, borrow from 16, and carry 1 to the ounces; when the lower ounces are greater, borrow from 16, and carry 1 to the lbs.; when the lower lbs. are greater, borrow from 28, and carry 1 to the qrs.; when the lower qrs. are greater, borrow from 4, and carry 1 to the cwts.; when the lower cwts. are greater, borrow from 20, and carry 1 to the tons—observing, in each case, to add the remainder to the upper number—and the tons as in simple subtraction.

EXAMPLES.

	12.						13.							14.						
	t.	cwt.	qrs.	lbs.	oz.	dr.	t.	cwt.	qrs.	lbs.	oz.	dr.		t.	cwt.	qrs.	lbs.	oz.	dr.
From	16	3	14	6	14		16	16	2	14	13	13		23	17	3	19	12	12
Take	12	1	8	4	8		12	17	3	19	15	15		17	18	3	23	13	13

Repeat the rule for Avoirdupois Weight.

CHEMISTS' WEIGHT.

RULE.—When the lower grs. are greater, borrow from 20, and carry 1 to the scruples; when the lower scruples are greater, borrow from 3, carry 1 to the drachms; when the lower drachms are greater, borrow from 8, carry 1 to the ounces; when the lower ounces are greater, borrow from 12, and carry 1 to the lbs., and the lbs. as in simple subtraction.

EXAMPLES.

	15.					16.					17.				
	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.
From	19	8	7	2	19	24	6	5	1	16	27	5	6	1	17
Take	15	5	5	1	16	19	8	7	2	19	23	7	7	1	19

Repeat the rule for Chemists' Weight.

LIQUID MEASURE.

RULE.—When the lower pints are greater, borrow from 2, and carry 1 to the quarts; when the lower quarts are greater, borrow from 4, and carry 1 to the gallons; when the lower gallons are greater, borrow from 63, and carry 1 to the hogsheads; when the lower hogsheads are greater, borrow from 4, and carry 1 to the tuns; and the tuns as in simple subtraction.

EXAMPLES.

	18.					19.					20.				
	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.
From	140	3	56	2	1	163	2	56	1	0	176	3	23	1	1
Take	131	2	50	1	1	94	3	61	1	1	100	3	39	1	1

Repeat the rule for subtracting Liquids.

DRY MEASURE.

RULE.—For every 2 pints, carry 1 to the quarts; for every 4 quarts, carry 1 to the gallons; for every 2 gallons, carry 1 to the pecks; for every 4 pecks, carry 1 to the bushels: for every 8 bushels, carry 1 to the quarters; and the quarters as in simple subtraction.

EXAMPLES.

	21.						22.						23.					
	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.
From	136	7	3	1	3	1	204	6	2	0	2	0	311	6	3	1	3	1
Take	52	2	1	0	2	0	19	6	3	1	1	1	204	7	2	1	1	1

Repeat the rule in subtracting Dry Measure.

	5.			6.			7.			8.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	1000	0	2	100	13	4	136	17	$2\frac{1}{2}$	746	18	$3\frac{1}{4}$
Take	999	19	$11\frac{3}{4}$	99	16	$8\frac{1}{2}$	76	19	$9\frac{1}{2}$	76	19	$8\frac{3}{4}$

NOTE.—When the lower farthings are greater, borrow from 4, add the remainder to the lesser, and carry 1 to the pence; when the lower pence are higher, borrow from 12, adding the remainder to the lesser, and carry 1 to the shillings; when the shillings are lower, borrow from 20, adding the remainder to the lesser, carry 1 to the pounds, and the pounds as in simple subtraction.

TROY WEIGHT.

RULE.—When the lower grains are greater, borrow from 24, adding the remainder to the upper, and carry 1 to the dwts.; when the lower dwts. are greater borrow from 20, adding 1 to the ozs.; when the lower ozs. are greater, borrow from 12, and carry 1 to the lbs.; and substract the lbs. as in simple subtraction.

EXAMPLES.

	lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.		lbs.	oz.	dwts.	grs.
9. From	5	6	13	14	10.	374	11	12	6	11.	197	11	13	13
Take	3	4	6	8		279	10	17	8		178	10	17	10

Repeat the rule for subtracting Troy Weight.

AVOIRDUPOIS WEIGHT.

RULE.—When the lower drs. are greater, borrow from 16, and carry 1 to the ounces; when the lower ounces are greater, borrow from 16, and carry 1 to the lbs.; when the lower lbs. are greater, borrow from 28, and carry 1 to the qrs.; when the lower qrs. are greater, borrow from 4, and carry 1 to the cwts.; when the lower cwts. are greater, borrow from 20, and carry 1 to the tons—observing, in each case, to add the remainder to the upper number—and the tons as in simple subtraction.

EXAMPLES.

	12.						13.							14.						
	cwt.	qrs.	lbs.	oz.	dr.		t.	cwt.	qrs.	lbs.	oz.	dr.		t.	cwt.	qrs.	lbs.	oz.	dr.	
From	16	3	14	6	14		16	16	2	14	13	13		23	17	3	19	12	12	
Take	12	1	8	4	8		12	17	3	19	15	15		17	18	3	23	13	13	

Repeat the rule for Avoirdupois Weight.

CHEMISTS' WEIGHT.

RULE.—When the lower grs. are greater, borrow from 20, and carry 1 to the scruples; when the lower scruples are greater, borrow from 3, carry 1 to the drachms; when the lower drachms are greater, borrow from 8, carry 1 to the ounces; when the lower ounces are greater, borrow from 12, and carry 1 to the lbs., and the lbs. as in simple subtraction.

EXAMPLES.

	15.					16.					17.				
	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.
From	19	8	7	2	19	24	6	5	1	16	27	5	6	1	17
Take	15	5	5	1	16	19	8	7	2	19	23	7	7	1	19

Repeat the rule for Chemists' Weight.

LIQUID MEASURE.

RULE.—When the lower pints are greater, borrow from 2, and carry 1 to the quarts; when the lower quarts are greater, borrow from 4, and carry 1 to the gallons; when the lower gallons are greater, borrow from 63, and carry 1 to the hogsheads; when the lower hogsheads are greater, borrow from 4, and carry 1 to the tuns; and the tuns as in simple subtraction.

EXAMPLES.

	18.					19.					20.				
	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.	t.	h.	g.	q.	p.
From	140	3	56	2	1	163	2	56	1	0	176	3	23	1	1
Take	131	2	50	1	1	94	3	61	1	1	100	3	39	1	1

Repeat the rule for subtracting Liquids.

DRY MEASURE.

RULE.—For every 2 pints, carry 1 to the quarts; for every 4 quarts, carry 1 to the gallons; for every 2 gallons, carry 1 to the pecks; for every 4 pecks, carry 1 to the bushels: for every 8 bushels, carry 1 to the quarters; and the quarters as in simple subtraction.

EXAMPLES.

	21.						22.						23.					
	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.
From	136	7	3	1	3	1	204	6	2	0	2	0	311	6	3	1	3	1
Take	52	2	1	0	2	0	19	6	3	1	1	1	204	7	2	1	1	1

Repeat the rule in subtracting Dry Measure.

27.—In a plank 8 ft. 7 in. 4 p. long, and 5 ft. 9 in. 3 p. broad, how many feet?

ft.	in.	p.		
8	7	4		
5	9	8		
43	0	8		
6	5	6	0	
	5	8	10	8
49	11	10	10	8 *Ans.*

NOTE.—This rule may be applied in finding the content of any dimensions in superficial measure, and cannot be proved without the aid of the foregoing diagram.

MULTIPLICATION OF WEIGHTS AND MEASURES.

EXAMPLES.

28.—Multiply 14 lb. 10 oz. 0 dwts. 21 grs. by 4.—*Ans.* 59 lb. 4 oz. 3 dwts. 12 grs.

29.—Multiply 17 ton, 17 cwt. 0 qrs. 24 lb. by 2.—*Ans.* 35 ton, 14 cwt. 1 qr. 20 lb.

30.—Multiply 14 cwt. 0 qrs. 21 lb. 0 oz. 14 drs. by 7.—*Ans.* 99 cwt. 1 qr. 7 lb. 6 oz. 2 drs.

31.—Multiply 10 lb. 6 oz. 4 drs. 1 sc. 17 grs. by 9.—*Ans.* 94 lb. 11 oz. 1 dr. 1 sc. 13 grs.

32.—Multiply 127 yds. 0 qrs. 3 n. by 12.—*Ans.* 1526 yds. 1 qr.

33.—Multiply 120 lea. 7 fur. 24 p. by 5.—*Ans.* 601 lea. 1 m. 6 fur. 0 p.

34.—Multiply 46 hdds. 47 gals. 7 pts. by 3.—*Ans.* 140 hhds. 17 gals. 5 pts.

35.—Multiply 365 days, 5 hrs. 48 m. 57 sec. by 12.—*Ans.* 4382 days, 21 hrs. 47 m. 24 sec.

COMPOUND DIVISION.

COMPOUND DIVISION is dividing compound numbers into any proposed number of equal parts.

RULE.—Begin to divide the highest denomination; if anything remain, you must find how many of the next lower denomination that remainder is equal to, and add them to the next numbers of the same denomination; and so proceed with each denomination till the work be done.

EXAMPLES OF COIN.

1.				2.				3.			
£.	s.	d.		£.	s.	d.		£.	s.	d.	
2 ÷ 225	2	4	by 2	3 ÷ 751	14	$7\frac{1}{2}$	by 3	4 ÷ 821	17	$9\frac{3}{4}$	by 4.
£112	11	2	Quot.	£250	11	$6\frac{1}{2}$	Quot.	£205	9	$5\frac{7}{12}$	Quot.

4.—Divide £64 19s. by 36.—*Ans.* £1 16s. 1d.

5.—Divide £37 14s. 8d. by 48.—*Ans.* 15s. $8\frac{3}{4}$d.

6.—Divide £190 4s. 6d. by 42.—*Ans.* £4 10s. 7d.
7.—Divide £4567 0s. 10d. by 55.—*Ans.* £83 0s. 8¾d.
8.—Bought 36 yds. of cloth for £17 2s.; what was it a yard.—*Ans.* 9s. 6d.
9.—If I pay yearly £96 16s. for 120 acres of land, what is it per acre?—*Ans.* 16s.
10.—Six persons purchase 3693 acres of land; what was each man's share?—*Ans.* 615 a. 2 r.
11.—Bought 132 lb. of green tea for £74 16s.; how must I sell it so as to neither gain nor lose by the bargain?—*Ans.* 11s. 4d.

EXAMPLES OF WEIGHTS AND MEASURES.

12.—Divide 8 lbs. 1 oz. 15 dwts. 8 grs. by 2.—*Ans.* 4 lbs. 0 oz. 17 dwts. 16 grs.
13.—Divide 24 tons 14 cwt. 0 qrs. 14 lbs. by 3.—*Ans.* 8 tons, 4 cwt. 2 qrs. 23⅓ lbs.
14.—Divide 4 lbs. 11 oz. 4 drs. 2 scrs. 12 grs. by 5.—*Ans.* 11 oz. 7 drs. 1 scr. 2⅖ grs.
15.—Divde 17 cwt. 2 qrs. 27 lbs. 14 oz. 15 drs. by 4.—*Ans.* 4 cwt. 1 qr. 20 lb. 15 oz. 11¾ drs.
16.—Divide 214 yds. 3 qrs. 2 nls. by 9.—*Ans.* 23 yds. 3 qrs. 2 nls.
17.—Divide 22 lea. 2 m. 0 f. 26 p. by 9.—*Ans.* 2 lea. 1 m. 4 f. 20⅔ p.
18.—Divide 140 a. 2 r. 26 p. by 12.—*Ans.* 11 a. 2 r. 35½ p.
19.—Divide 146 d. 23 h. 24 m. 56 s. by 6.—*Ans.* 24 d. 11 h. 54 m. 9⅓ s.
20.—Divide 147 yds. 2 ft. 11 in. by 10.—*Ans.* 14 yds. 2 ft. $4\frac{7}{10}$ in.
21.—Divide 24 hhds. 57 gals. by 11.—*Ans.* 2 hhds. 16 gals. 2 qts. $1\frac{1}{10}$ pt.
22.—Divide 120 e.E. 4 qrs. by 8.—*Ans.* 15 e.E. 0 qr. 2 na.
23.—Divide 10 tuns, 1 p. 1 hhd. 60 gals. 3 qts. by 8.—*Ans.* 1 tun, 0 p. 1 hhd. 31 gals. 0¾qt.

Repeat the rule for Compound Division.

COMPENDIUMS.

PROBLEM 1.

How to find what number of hundreds, pounds, yards, ells, &c., may be bought for any sum of money; the price of one being given in any even number of shillings.

RULE.—Annex a cipher to the right hand of the given money, and divide by half the proposed price.

EXAMPLES.

24.—If a yard of cloth cost 8s., how many yards may be bought for £16?—

£.
4 ÷ 160

Ans. 40 yards.

25.—How many yards of linen, at 6s. per yard, can I have for £48?—*Ans.* 160 yards.

26.—How many cwts. of sugar can I have for £80, if it be sold at 30s. per cwt.?—*Ans.* 44 cwt. 1 qr. 21$\frac{7}{9}$ lbs.

27.—How many cwts. of butter, at 42s. per cwt., can I buy for £126?—*Ans.* 60 cwt.

QUERY.

The price of one being given in even shillings, how will you find the amount of any number of hundreds, yards, ells, &c.? Repeat the rule.

LIQUID MEASURE.

PROBLEM 2.

By knowing the price of a gallon, to find the price of a tun.

RULE.—To the price of a gallon in pence add one-twentieth of itself, and the sum will be the answer in pounds sterling.

EXAMPLES.

28.—If a gallon cost 6s. 3d., what will a tun cost?

20 ÷ 75d.
3 15

Ans. £78 15s.

29.—If 1 gallon of rum cost 14s. 9d., what is the price of a tun?—*Ans.* £185 17s.

To reverse this rule.

From the price of the tun subtract one-third of one-seventh of the price, and the remainder will be the price of a gallon in pence?

30.—If 1 tun cost £78 15s., what is that a gallon?

	£.	s.
7 ÷	78	15
3 ÷	11	5
	3	15

£75 0 & 75d. = 6s. 3d. per gal.

Having finished all the simple and compound rules, which, it is hoped, will leave the pupil in full possession of exercising in the different denominations, we next proceed to furnish a *general* rule for the computation of yards, quarters, ells, nails, lbs., gallons, &c., to be calculated at any given number of pence, from $\frac{1}{4}$d. to 11$\frac{3}{4}$d. per yard, per quarter, per ell, per nail, per lb., per gallon, &c., &c.

Rule.—Exchange the quantity and price for each other, and multiply by the price; or find the amount at a penny, and multiply by the number of pence; or, if fractions occur, for ¼ add ¼d., ½ add ½d., ¾ add ¾d., and so on.

EXAMPLES.

1.—12 lbs. at 7d. per lb.: say 12d. are 1s., and 7 times 1 are 7s.
2.—24 lbs. at 13d. per lb.: say 24d. are 2s., and 13 times 2 are £1 6s.
3.—48 lbs. at 9d. per lb.: say 48d. are 4s., and 9 times 4 are £1 16s.
4.—13 lbs. at 11d. per lb.: say 13d. are 1s. 1d., and 11 times 1s. 1d. are 11s. 11d.
5.—112 lbs. at 11d. per lb.: say 112d. are 9s. 4d., and 11 times 9s. 4d. are £5 2s. 8d.
6.—36 yards, at 11d. per yard: say 36d. are 3s., and 11 times 3s. are £1 13s.
7.—60 gallons, at 7d. per gal.: say 60d. are 5s., and 7 times 5s. are £1 15s.
8.—72 feet, at 5d. per foot: say 72d. are 6s., and 5 times 6s. are £1 10s.
9.—84 lbs., at 7d. per lb.: say 84d. are 7s., and 7 times 7s. are £2 9s.
10.—96 oz., at 8d. per oz.: say 96d. are 8s., and 8 times 8s. are £3 4s.
11.—120 lbs., at 10d. per lb.: say 120d. are 10s., and 10 times 10s. are £5.
12.—132 lbs., at 11d.: say 132d. are 11s., and 11 times 11s. are £6 1s.
13.—189 yards, at 9d. per yard: say 189d. are 15s. 9d., and 9 times 15s. 9d. are £7 1s. 9d.
14.—280 lbs., at 11d. per lb.: say 280d. are £1 3s. 4d., and 11 times £1 3s. 4d. are £12 16s. 8d.
15.—126 gallons, at 11d. per gallon: say 126d. are 10s. 6d., and 11 times 10s. 6d. are £5 15s. 6d.
16.—252 gallons, at 10d. per gallon: say 252 pence are 21s., and 10 times 21s. are £10 10s.
17.—300 lbs., at 7d. per lb.: say 300d. are 25s., and 7 times 25s. are £8 15s.
18.—400 yards, at 9d. per yard: say 400d. are 33s. 4d., and 9 times 33s. 4d. are £15.

When Fractions occur, as per rule, for a quarter allow a ¼d., for a half a ½d., and so on.

19.—42½ lbs., at 7d. per lb.: say 42½d. are 3s. 6½d., and 7 times 3s. 6½d. are £1 4s. 9½d.
20.—65¼ oz., at 5d. per oz.: say 65¼d. are 5s. 5¼d., and 5 times 5s. 5¼d are £1 7s. 2¼d.
21.—87¾ lbs., at 8d.: say 87¾d. are 7s. 3¾d., and 8 times 7s. 3¾d. are £2 18s. 6d.
22.—99⅛ yards, at 4d. per yard: say 99⅛d. are 8s. 3⅛d., and 4 times 8s. 3⅛d. are £1 13s. 0½d.
23.—140⅜ oz., at 7d. per oz.: say 140⅜d. are 11s. 8⅜d., and 7 times 11s. 8⅜d. are £4 1s. 10⅝d.
24.—145⅝ lbs., at 10d. per lb.: say 145⅝d. are 12s. 1⅝d., and 10 times 12s. 1⅝d. are £6 1s. 4½d.
25.—37⅛ yards, at 11d. per yard; say 37⅛d. are 3s. 1⅛d., and 11 times 3s. 1⅛d. are £1 14s. 0⅜d.
26.—260⅞ lbs., at 9d. per lb.: say 260⅞d. are 21s. 8⅞d., and 9 times 21s. 8⅞d. are £9 15s. 7⅞d.

27.—99¾ lbs., at 10d. per lb.: say 99¾d. are 8s. 3¾d., and 10 times 8s. 3¾d. are £4 3s. 1½d.

28.—26½ lbs., at 5d. per lb.: say 26½d. are 2s. 2½d., and 5 times 2s. 2½d. are 11s. 0½d.

29.—88¼ lbs., at 7d. per lb.: say 88¼d. are 7s. 4¼d., and 7 times 7s. 4¼d. are £2 11s. 5¾d.

30.*—183⅜ yards, at 10d. per yard: say 183⅜d. are 15s. 3⅜d., and 10 times 15s. 3⅜d. are £7 13s. 0¼d.

31.—21 yards of linen at 7½d. per yard: say 21d. are 1s. 9d., and 7½ times 1s. 9d. are 13s. 1½d.

32.—27 quires of paper at 9¼d. per quire: say 27d. are 2s. 3d., and 9¼ times 2s. 3d. are £1 0s. 9¾d.

33.—39 lbs. of cheese at 7¾d. per lb.: say 39d. are 3s. 3d., and 7¾ times 3s. 3d. are £1 5s. 2¼d.

When a Fraction is in the Price.

RULE.—Call the lbs., yards, &c., pence, which bring to shillings, and pence; multiply by the pence and fraction, as follows:—

34.—48 lbs., at 7¼d. per lb.: say 48d. are 4s., and 7¼ times 4s. are £1 9s.

35.—60 lbs., at 5½d. per lb.: say 60d. are 5s., and 5½ times 5s. are £1 7s. 6d.

36.—72 lbs., at 9¾d. per lb.: say 72d. are 6s., and 9¾ times 6s. are £2 18s. 6d.

37.—84 gallons, at 11½d. per gallon: say 84d. are 7s., and 11½ times 7s. are £4 0s. 6d.

38.—96 yds., at 10¾d. per yd.: say 96d. are 8s., and 10¾ times 8s. are £4 6s.

39.—108 yards, at 6⅛d. per yard: say 108d. are 9s., and 6⅛ times 9s. are £2 15s. 1½d.

40.—125 yards, at 11⅕d. per yard: say 125d. are 10s. 5d., and 11⅕ times 10s. 5d. are £6 2s. 11d.

41.—133 yards, at 10½d. per yard: say 133d. are 11s. 1d., and 10½ times 11s. 1d. are £5 6s. 4½d.

NOTE.—As this rule is of importance to the accountant, it is expected it will be studied attentively. It will be found of great service to young men and shopkeepers.

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* It is necessary here to explain the application of this rule in the fractions. One example will suffice for all: we make use of the question No. 30 for the purpose, and trust the illustration will appear clear to any capacity.

We have here 183⅜ yards, at 10d. per yard:—

183⅜d. = 15s. 3⅜d., and

	s.	d.	
	15	3⅜	× by 10 stands thus:
	10		
£7	13	0¼	

We multiply first the numerator of the fraction by 10, saying 10 times ⅜ are 50 8ths, which is 6 whole numbers, and 2 8ths, or ¼; we write down ¼ and carry 6 to the pence, and multiply the pence and shillings in the ordinary way, and so on with any other number. Remember,—after multiplying the numerator, divide by the denominator, and the quotient will be so many pence, setting down the remaining fraction in its proper place.

NOTE.—Every contract being made for pounds, shillings, and pence, and the standard currency so established that 12d. make a shilling, and 240d. a pound, the equation of these two numbers, properly arranged, with their component parts, embraces the entire of mercantile calculations; hence the system we lay down will be found of the greatest utility to expedite the accountant in the discharge of his mercantile pursuits.

For 15	take 1	one-fourth	times 12	For 85	take 7	one-twelfth	times 12
... 17	... 1	five-twelfth	 12	... 87	... 7	one-fourth	 12
... 19	... 1	seven-twelfth	... 12	... 89	... 7	five-twelfth	 12
... 20	... 1	two-third	 12	... 91	... 7	seven-twelfth	... 12
... 21	... 1	three-fourth	... 12	... 93	... 7	three-fourth	 12
... 22	... 1	eleven-twelfth	... 12	... 95	... 7	eleven-twelfth	... 12
... 26	... 2	one-sixth	 12	... 97	... 8	one-twelfth	 12
... 28	... 2	one-third	 12	... 99	... 8	one-fourth	 12
... 29	... 2	five-twelfth	 12	... 101	... 8	five-twelfth	 12
... 31	... 2	seven-twelfth	... 12	... 103	... 8	seven-twelfth	... 12
... 33	... 2	three-fourth	... 12	... 105	... 8	three-fourth	 12
... 35	... 2	eleven-twelfth	... 12	... 107	... 8	eleven-twelfth	... 12
... 37	... 3	one-twelfth	 12	... 109	... 9	one-twelfth	 12
... 39	... 3	one-fourth	 12	... 111	... 9	one-fourth	 12
... 41	... 3	five-twelfth	 12	... 113	... 9	five-twelfth	 12
... 43	... 3	seven-twelfth	... 12	... 115	... 9	seven-twelfth	 12
... 45	... 3	three-fourth	... 12	... 117	... 9	three-fourth	 12
... 47	... 3	eleven-twelfth	... 12	... 119	... 9	eleven-twelfth	... 12
... 50	... 4	one-sixth	 12	... 121	... 10	one-twelfth	 12
... 52	... 4	one-third	 12	... 123	... 10	one-fourth	 12
... 54	... 4	one-half	 12	... 125	... 10	five-twelfth	 12
... 55	... 4	seven-twelfth	... 12	... 127	... 10	seven-twelfth	 12
... 57	... 4	three-fourth	... 12	... 129	... 10	three-fourth	 12
... 59	... 4	eleven-twelfth	... 12	... 131	... 10	eleven-twelfth	... 12
... 61	... 5	one-twelfth	 12	... 133	... 11	one-twelfth	 12
... 63	... 5	one-fourth	 12	... 135	... 11	one-fourth	 12
... 65	... 5	five-twelfth	 12	... 137	... 11	five-twelfth	 12
... 67	... 5	seven-twelfth	... 12	... 139	... 11	seven-twelfth	 12
... 69	... 5	three-fourth	... 12	... 141	... 11	three-fourth	 12
... 71	... 5	eleven-twelfth	... 12	... 143	... 11	eleven-twelfth	... 12
... 73	... 6	one-twelfth	 12	... 145	... 12	one-twelfth	 12
... 75	... 6	one-fourth	 12	... 147	... 12	one-fourth	 12
... 77	... 6	five-twelfth	 12	... 149	... 12	five-twelfth	 12
... 79	... 6	seven-twelfth	... 12	... 151	... 12	seven-twelfth	 12
... 81	... 6	three-fourth	... 12	... 153	... 12	three-fourth	 12
... 83	... 6	eleven-twelfth	... 12	... 155	... 12	eleven-twelfth	... 12

NOTE.—The above table should be got off correctly, and when committed to memory, the pupil will be able in an instant to tell the amount of any quantity, at any price, from 12 to 240. This table is original, and constructed to facilitate the calculation of either even, odd, evenly even, evenly odd, oddly odd, composite, plain, solid, perfect, harmonic, and square numbers, in any case, as far as 12 reaches.

EXERCISE I.

Given the value of an Integer, either abstract or applicate, to determine the value of any proposed number or specie of the same kind, by the equation of the number twelve.

RULE.—Call the pence which one costs shillings, and it is done. If a halfpenny, farthing, or three farthings, be affixed to the price, call the halfpenny sixpence, and count threepence for each farthing. If fractions occur for $\frac{1}{2}$, say 1½d.; $\frac{5}{12}$, 4½d.; $\frac{7}{12}$, 7½d.; $\frac{1}{12}$, 1d.; $\frac{3}{12}$, 3d.; $\frac{7}{12}$, 7d.; $\frac{1}{6}$, 2d.; $\frac{5}{6}$, 10d.

The reason of the above rule is founded on this obvious principle:—When a lb. costs 1d., one shilling will be the cost of 12 lbs., that is, a shilling to the penny. Hence, in general, as many pence as a lb. costs, as many shillings will 12 lbs. cost; also, if a lb. costs a halfpenny, 12 lbs. will cost sixpence, and if a lb. costs a farthing, 12 lbs. will cost threepence; which is the reason of calling the pence shillings, the halfpenny sixpence, and threepence for each farthing, and so with any fractional part, or parts of a shilling.

This general proposition and its equivalent envelopes the whole system of mercantile calculations, and can be briefly analyzed into three particular cases.

First, the number whose value is required, must be either equal, greater, or less than 12. If 12, agreeably to this system, it admits but of one infallible rule; if less, of three; and if greater, of four operative ones.

With respect to the particular cases, observe, that a number less than 12, may be an exact measure of 12, or prime to it; also, a number greater than 12 may be a multiple of 12, or prime to it. Each of these cases will be minutely considered, and carefully arranged under its distinct head; and as 12 is the equation to this section, we shall first take it into consideration.

Knowing the price of 1, *to find the value of* 12, *as per rule.*

Call the pence which one costs shillings, and it is done: if a halfpenny, farthing, or three farthings, be affixed to the price, call the halfpenny sixpence, the farthing threepence, the three farthings ninepence, and this will give the true answer. For example—if a lb. of sugar cost seven pence, 12 lbs. will cost as many shillings; if a lb. cost 6½d., call the sixpence six shillings, and the halfpenny sixpence, and it will be the price of 12 lbs.

Also, if a lb. cost 9½d., call the 9d. nine shillings, and 3d. for the farthing, you have the price of 12 lbs. = 9s. 3d. Again, if a lb. cost 5¾d., call the 5d. five shillings, and count 9d. for the three farthings, you have the price of 12 lbs. = 5s. 9d.

Finally, if the price per integer should amount to shillings, pence, &c., reduce the shillings and pence to pence; call the pence shillings, and you have the amount of 12 lbs., as per rule.

A few examples will render this exercise familiar, which the learner is particularly cautioned not to pass over, until he is able to tell at once the amount of 12, at any proposed price per integer, which is best effected by studying attentively and practising the following examples.

PROBLEM 1.

1.—At 17½d. per yard, what is the value of 12 yards?—*Ans.* 17s. 6d.
2.—At 15¾d. per lb., what is the value of 12 lbs.?—*Ans.* 15s. 9d.

NOTE.—The pupil is to answer such queries as soon as proposed, by allowing a shilling to the penny, sixpence to the halfpenny, and threepence to each farthing, and take the fractional parts of a shilling, as laid down in the rule.

EXAMPLES.

3.—12 lbs., at 8d. per lb.?—*Ans.* 8s.
4.—12 lbs., at 7¾d. per lb.?—*Ans.* 7s. 9d.
5.—12 lbs., at 15½d. per lb.?—*Ans.* 15s. 3d.
6.—12 lbs., at 17¾d. per lb.?—*Ans.* 17s. 9d.
7.—12 planks, at 23½d. per plank?—*Ans.* £1 3s. 6d.
8.—12 yards, at 24½d. per yard?—*Ans.* £1 4s. 6d.
9.—12 yards of red baize, at 2s. 6d.?—*Ans.* £1 10s. 0d.
10.—12 lbs. of salmon, at 2s. 7½d. per lb.?—*Ans.* £1 11s. 6d.
11.—12 gallons of ginger wine, at 8s. 9½d. per gallon?—£5 5s. 3d.
12.—12 pairs of silk stockings, at 4s. 10d. per pair?—*Ans.* £2 18s.
13.—12 cambric shirts, at 12s. 10½d. per shirt?—*Ans.* £7 14s. 6d.
14.—12 dozen of wax candles, at 9s. 8d. per dozen?—*Ans.* £4 16s.
15.—12 yards of silk velvet, at 16s. 9d. per yard?—*Ans.* £10 1s.
16.—12 yds. of broad cloth, at 17s. 11½d. per yd.?—*Ans.* £10 15s. 6d.
17.—12 flannel waistcoats, at 2s. 9½d. each?—*Ans.* £1 13s. 6d.
18.—12 bushels of pollard, at 2s. 3½d. per bushel?—*Ans.* £1 7s. 6d.
19.—12 maps, at 16s. per map?—*Ans.* £9 12s.
20.—12 dressing cases, at 8s. 9½d. a piece?—*Ans.* £5 5s. 6d.
21.—12 candlesticks, at 5s. 10½d. a piece?—*Ans.* £3 10s. 3d.
22.—12 dozen of sherry, at £1 18s. 9d. per dozen?—*Ans.* £23 5s.
23.—12 yards of brocade, at 7s. 9⅜d. per yard?—*Ans.* £4 13s. 7½d.
24.—12 pieces of calico, at 5s. $3\frac{5}{12}$d. per piece?—*Ans.* £3 3s. 5d.
25.—12 dozen of ribbon, at 4s. 7⅛d. per dozen?—*Ans.* £2 15s. 1½d.
26.—12 pieces of muslin, at 9s. 5⅝d. per piece?—*Ans.* £5 13s. 5½d.
27.—12 lbs. of thread, at 1s. 11⅛d. per lb.?—*Ans.* £1 3s. 10d.
28.—12 pieces of lawn, at 13s. 9⅞d. per piece?—*Ans.* £8 5s. 10½d.
29.—12 ounces of silver, at 4s. $7\frac{3}{8}$d. per ounce?—*Ans.* £2 15s. 2¼d.
30.—12 lbs. of silk, at 11s. $8\frac{7}{16}$d. per lb.?—*Ans.* £7 0s. 5¼d.

PROBLEM 2.

To calculate the amount of any number from 12 *to* 24.

RULE.—Call the pence, &c., which the integer costs shillings, which increase by the same part of itself that the excess is of 12, if the excess be an exact measure of 12; but if prime, add the value of the prime part; the sum will be the value of the proposed number.

EXAMPLES.

31.—What is the value of 18 lbs. of beef, at 5½d. per lb.?—*Ans.* 8s. 3d.
32.—What is the price of 17 lbs. of butter, at 13½d. per lb.?—*Ans.* 18s. 9½d.
33.—What is the amount of 19½ stones of flour, at 2s. 5½d. per stone?—*Ans.* £2 7s. 11½d.

34.—What will 23 lbs. of tea come to, at 6s. 7½d. per lb.?—*Ans.* £7 12s. 4½d.
35.—What will 22 lbs. of coffee come to, at 1s. 9¾d. per lb.?—*Ans.* £1 19s. 10½d.
36.—What will 17 stones of sugar come to, at 6s. 10¾d. per stone?—*Ans.* £5 17s. 2¾d.
37.—What will 16⅛ yards of cloth come to, at 15s. 6½d. per yard?—*Ans.* £12 10s. $7\frac{5}{8}$d.
38.—What will 14¾ cwt. of sugar come to, at £1 19s. 7d. per cwt.?—*Ans.* £29 3s. 10½d.
39.—What will 13¾ gallons of brandy come to, at 15s. 9½d. per gallon?—*Ans.* £10 17s. 1⅛d.
40.—What is the price of 19½ reams of paper, at 7s. 9½d. per ream?—*Ans.* £7 12s. 4½d.
41.—What is the amount of 23½ lbs. of leather, at 2s. 8½d. per lb.?—*Ans.* £3 3s. 7¾d.

PROBLEM 3.

The reverse: having the amount of twelve, to find the price of one.

Rule.—As many shillings as twelve are worth, so many pence will one cost.

EXAMPLES.

42.—If 12 pigeons cost 8s., what is one worth?—*Ans.* 8d.
43.—12 yards of linen cost 16s., what is the price of one?—*Ans.* 1s. 4d.
44.—If 12 pairs of stockings cost 4s. 8d., what is that a pair?—*Ans.* 4¾d.
45.—Bought 12 gallons of cider for £1, what is that a gallon?—*Ans.* 1s. 8d.
46.—Paid £1 10s. for a dozen silk handkerchiefs, what were they a piece?—*Ans.* 2s. 6d.
47.—Gave £2 14s. for 12 yds. of kersey, what is that per yd.?—*Ans.* 4s. 6d.
48.—12 geese for £3 12s., what is that a piece?—*Ans.* 6s.
49.—Paid £6 for a dozen hats, what is that for one?—*Ans.* 10s.
50.—If I pay £3 16s. for 12 yards of holland, how much is that a yard?—*Ans.* 6s. 4d.
51.—If I buy a doz. rose trees for £2 10s., what is one worth?—*Ans.* 4s. 2d.
52.—12 lamps for £3 9s., what is that a piece?—*Ans.* 5s. 9d.
53.—If a dozen of gloves cost £2 16s., what is that a pair?—*Ans.* 4s. 8d.
54.—12 cloth caps for £1 7s., what is that for one?—*Ans.* 2s. 3d.
55.—12 baskets of fruit for £1 15s., what is that each?—*Ans.* 2s. 11d.
56.—12 window blinds for £4 18s., what is that for one?—*Ans.* 8s. 2d.
57.—12 bottles of port wine cost £2 8s., what is that a bottle?—*Ans.* 4s.
58.—1 doz. of champagne cost 5 guineas, what is that a bottle?—*Ans.* 8s. 9d.
59.—12 pair of candlesticks for £2 16s., what is that a pair?—*Ans.* 4s. 8d.
60.—A dozen of tent wine for 24s. 6d., what is it a bottle?—*Ans.* 2s. 0½d.

PROBLEM 4.

Having the price of any number of which 12 *is the multiple, to find the price of one.*

Rule.—Find how many twelves are in the number of articles; then bring the amount into shillings, and divide by the number of twelves; the result will be the price of one in pence.

EXAMPLES.

61.—Bought 48 pairs of scissors for £1 4s., what is that a pair?—*Ans.* 6d.
62.—72 yards of drab cloth for £3 6s., what is that a yard?—*Ans.* 11d.
63.—48 chair covers for £1 16., what was the price of one?—*Ans.* 9d.
64.—12 dozen of mould candles for £3 18s., what is that a lb.?—*Ans.* 6½d.
65.—60 brass finger plates for £7 10s, what is one worth?—*Ans.* 2s. 6d.
66.—120 flower pots for £2, what is one worth at that rate?—*Ans.* 4d.
67.—36 work-boxes for £4 19s., what is the price of one?—*Ans.* 2s. 9d.
68.—132 arithmetics for £4 19s., what is the price of one?—*Ans.* 9d.
69.—108 pieces of dinner service for £2 5s., what is that a piece?—*Ans.* 5d.
70.—96 glass frames for £62 16s. what is that a piece?—*Ans.* 13s. 1d.
71.—84 packages, value £23 2s., what is each one worth?—*Ans.* 5s. 6d.
72.—72 yards of cambric for £16 10s., what was it a yard?—*Ans.* 4s. 7d.
73.—If a servant's wages be £20 a year, what is that per month?—*Ans.* £1 13s. 4d.

Repeat the rule for finding the price of any number of which 12 is a multiple, the price of one being given.

PROBLEM 5.

The amount of any number of articles given, not an even multiple of 12, *to find the value of one.*

RULE.—1. Call the number of articles pence. 2. If these pence amount to shillings and pence, divide the shillings of the given value by the shillings, and the pence also by the pence. If both the pence and shillings give the same product, that number is the value of one article in pence.

EXAMPLES.

74.—If I pay £2 9s. 7d. for 85 lamp glasses, what is the cost of one?

85 glasses as pence = 7s. 1d.
£2 9s. 7d. = 49s. 7d. Divide 49s. by 7s. = 7d., price of one lamp.
Divide 7d. by 1d. = 7d.

NOTE.—Observe, the product of both divisions is 7; therefore, the price of one lamp is 7d.

75.—107 yards of printed calico for £4 0s. 3d., what was it per yard?

s. d. s. d. s. d. s.
Yards as pence, 107 = 8 11. 8 11 ÷ 80 3 = 9 = 9d., value of 1 yard.
£4 0s. 3d. = 80 3.

Observe, that 8 is contained in 80 exactly 10 times; but 11 cannot be divided into 3; therefore take one less, and carry the surplus to the pence and divide by 11, and the sum 9 = 9d. is the result. Adopt a similar course in every other case.

76.—Bought at a sale 42 salvers for £1 18s. 6d., what was that a piece?—*Ans.* 11d. each.
77.—Bought 61 sheets of card-board for £1 0s. 4d., what was one worth? *Ans.* 4d.
78.—If I pay £1 4s. 6d. for 98 lemons, what is that for one?—*Ans.* 3d.
79.—Bought 109 knives for £2 5s. 5d., what are they a piece?—*Ans.* 5d.

80.—50 flower pots for 8s. 4d., what is one worth?—*Ans.* 2d.
81.—Bought 97 hand screens for £3 12s. 9d., what was that for each?—*Ans.* 9d.
82.—37 drawing copies for £1 13s. 11d., what is one worth?—*Ans.* 11d.
83.—If 63 squares of glass cost 15s. 9d., what is one worth?—*Ans.* 3d.
84.—Bought 50 turkey eggs for £1 0s. 10d., what were they a piece?—*Ans.* 5d.
85.—If 37 rabbits cost £1 13s. 11d., what is one worth?—*Ans.* 11d.
86.—If the carriage of 107 tons cost £3 2s. 5d., what is that per ton?—*Ans.* 7d.
87.—If the laying of 91 feet of railway cost £3 0s. 8d., what is that per foot?—*Ans.* 8d.
88.—If 115 measures of strawberries cost £4 15s. 10d., what did one cost? *Ans.* 10d.
89.—If 83 pickled tongues cost £3 2s. 3d., what is one worth?—*Ans.* 9d.
90.—If 77 quarts of oil cost £3 11s. 4d., what is one worth?—*Ans.* 8d.
91.—Bought 127 candlesticks for £5 5s. 10d., what is the price of one?—*Ans.* 10d.
92.—If 88 lbs. of beef cost £1 16s. 8d., what is it a lb.?—*Ans.* 5d.
93.—If 113 peaches cost £2 16s. 6d., what is one worth?—*Ans.* 6d.
94.—Bought 55 bushels of beans for £2 10s. 5d., what is that a bushel? *Ans.* 11d.
95.—35 ounces of thread for £1 3s. 4d, what is that per ounce—*Ans.* 8d.
96.—Bought 22 hand baskets for 18s. 4d., what is that a piece?—*Ans.* 10d.
97.—129 door handles for £4 16s. 9d., what is that a piece?—*Ans.* 9d.
98.—40 nectarines for 13s. 4d., what is that for one?—*Ans.* 4d.
99.—If 105 padlocks cost £4 16s. 3d., what is one worth?—*Ans.* 11d.
100.—32 cards of steel pens for £1 9s. 4d., what is one worth?—*Ans.* 11d.
101.—If 71 lbs. of sugar cost £1 9s. 7d., what is it a pound?—*Ans.* 5d.
102.—If 140 lbs. of sugar cost £5 16s. 8d., what is that a lb.?—*Ans.* 10d.

PROBLEM 6.

To calculate for any multiple of 12, *or for any number that contains* 12, *evenly, the price of one being given.*

RULE.—Call the pence shillings, the halfpenny 6d., and count 3d. for every farthing, as taught in rule the first; which multiply by the number of twelves contained in the given number; the result will be the answer.

Reason.—When the price of one in pence is called shillings, it is the value of 12; and when the value of 12 is multiplied by the number of twelves, the result is the amount of the given number.

103.—What is the price of 24 lbs. of beef, at 3¾d. per lb.?

Write 3s. 9d. for 3¾d., and it is the value of 12, per rule the first, and this multiplied by 2, the number of twelves contained in the given number, the result is the answer.

	s.	d.
	3	9
		2
Ans.	7	6

104.—What are 24 lbs. of cheese worth, at 6½d. per lb.?—*Ans.* 12s. 6d.
105.—What are 36 lbs. of mutton worth, at 4½d. per lb.?—*Ans.* 13s. 6d.
106.—72 lbs. of lamb, at 9¼d. per lb.?—*Ans.* £2 15s. 6d.
107.—84 yards of silk velvet, at 9s. 8¾d. per yard.—*Ans.* £40 17s. 3d.
108.—60 lbs. of currants, at 6¾d. per lb.?—*Ans.* £1 13s. 9d.
119.—96 parlour locks, at 3s. 7½d. each?—*Ans.* £17 8s.
110.—48 sets of fire irons, at 5s. 5½d. a set?—*Ans.* £13 2s.
111.—120 pair of gloves, at 2s. 3½d. a pair?—*Ans.* £13 15s.
112.—84 yards of Flanders lace, at 7s. 11½d. per yard?—*Ans.* £33 8s. 6d.
113.—120 gallons of rum, at 13s. 10d. per gallon?—*Ans.* £83.
114.—60 lbs. of tobacco, at 3s. 3½d. per lb.?—*Ans.* £9 17s. 6d.
115.—96 lbs. of green tea, at 8s. 9d. per lb.?—*Ans.* £42.
116.—132 qrs. of barley, at £1 13s. 9d. per qr.?—*Ans.* £222 15s.
117.—108 yards, at 2s. 9½d. per yard?—*Ans.* £15 1s. 6d.
118.—132 yards, at 6s. 3½d. per yard?—*Ans.* £41 10s. 6d.
129.—144 yards, at 7s. 9½d. per yard?—*Ans.* £55 19s.
120.—What are 84 lbs. of leather worth, at 3½d. per lb.?—*Ans.* £1 6s. 3d.
121.—What are 120 stones of oats worth, at 7d. per stone?—*Ans.* £3 10s.
122.—What are 240 ounces of spice worth, at 8d. per ounce?—*Ans.* £8.
123.—What are 480 yards of calico worth, at 9d. per yard?—*Ans.* £18.
124.—What are 600 yards of linen worth, at 11d. per yard?—*Ans.* £27 10s.
125.—What are 840 lbs. of cheese worth, at 7d. per lb.?—*Ans.* £24 10s.
126.—What are 1080 lbs. of starch worth, at 7d. per lb.?—*Ans.* £31 10s.
127.—What are 1200 lbs. of coffee worth, at 8d. per lb.?—*Ans.* £40.
128.—What are 1320 yards of stuff worth, at 9d. per yard?—*Ans.* £49 10s.

QUERY.

How do you calculate the amount of any multiple of 12? Give the rule and the reason.

PROBLEM 7.

Having the price of one, to know the amount of any number greater than 12, *but prime to it, at the same rate per integer.*

RULE.—Set down the price of twelve; multiply by the number of twelves contained in the given number, to which add the amount of the prime part; the aggregate will be the amount of the proposed number.

EXAMPLES.

129.—What is the amount of 25½ stones of wheat, at 17½d. per stone?

£.	s.	d.			£.	s.	d.	
0	17	6 × 2		Otherwise:	2	2	6	
						5	3¾	its one-eighth.
1	15	0						
	2	2¼			£1	17	2¼	See rule for scores.
£1	17	2¼						

130.—What is the price of 73 lbs. of butter, at 6½d. per pound?—*Ans.* £1 19s. 6¼d.
131.—What is the amount of 85 lbs. of beef, at 3½d. per pound?—*Ans.* £1 3s. 0¼d.

132.—What is the price of 137 lbs. of worsted, at 17½d. per lb.?—*Ans.* £9 19s. 9½d.

133.—What will 90 lbs. of tobacco come to, at 3s. 6½d. per lb.?—*Ans.* £15 18s. 9d.

134.—What is the price of 54 stones of flour, at 2s. 3½d. per stone?—*Ans.* £6 3s. 9d.

135.—What is the amount of 104 yards of broad cloth, at 8s. 6¾d. per yard?—*Ans.* £44 10s. 6d.

136.—What is the price of 47 cwt. of fine flour, at 16s. 8½d. per cwt.?—*Ans.* £39 5s. 3½d.

137.—What is the cost of 76 gallons of rum, at 14s. 8½d. per gallon?—*Ans.* £55 17s. 10d.

138.—What is the price of 130 gallons of wine, at 17s. 9¾d. per gallon?—*Ans.* £115 15s. 7½d.

139.—What will the yearly rent of a farm, containing 52 acres, come to, at £1 3s. 6d. per acre?—*Ans.* £61 2s. 0d.

140.—What is the amount of 27½ cwt. of sugar, at £2 12s. 6d. per cwt.?—*Ans.* £72 3s. 9d.

141.—What is the price of 127 yards of cambric, at 8s. 9¾d. per yard?—*Ans.* £55 19s. 2¼d.

QUERY.

To find the amount of any number, greater than 12, but prime to it, how do you proceed? Give the rule.

CALCULATION OF LACE.

As this branch of mercantile business varies much in price, and frequently embraces a variety of fractions, often presenting difficulties to both buyer and seller, the following questions will be found sufficient to facilitate the accountant in totting up the amount of any quantity, at any price, with the greatest despatch. The same method may be applied in other calculations wherever fractions are annexed to the price; it may also be used with great advantage in interest, measurement of either superfices or solids, &c.

RULE.—Apply the dozen as before directed. For ⅛, count 1½d.; for $\frac{1}{16}$, ¾d.; for $\frac{1}{32}$, ⅜d.

EXAMPLES.

1.—What is the amount of 2 doz. of Nottingham lace, at $16\frac{1}{16}$d. per yd.?

Operation.

	s.	d.	s.	d.
12 yds. at	1	$4\frac{1}{16}$ =	16	$0\frac{3}{4}$, which double for 2 dozen.
			2	
	£1	12	$1\frac{1}{2}$	*Ans.*

2.—What will $2\frac{1}{2}$ dozen of edging come to, at $3\frac{1}{4}$d. per yard?

	s.	d.
12 at $3\frac{1}{4}$d =	3	9
		$2\frac{1}{2}$
	7	6
	1	$10\frac{1}{2}$ price of $\frac{1}{2}$ dozen.
Ans.	9	$4\frac{1}{2}$

3.—What is the amount of $5\frac{1}{2}$ dozen of thread lace, at 1s. $10\frac{1}{2}$d. per yard?—*Ans.* £6 1s. $2\frac{1}{6}$d.

4.—What will $9\frac{1}{2}$ dozen figured lace come to, at $9\frac{3}{8}$ per yard?—*Ans.* £4 7s. $3\frac{3}{4}$d.

5.—Tell the amount of $16\frac{1}{2}$ dozen of silk lace, at 5s. $7\frac{3}{4}$d. per yard?—*Ans.* £54 14s. $10\frac{1}{8}$d.

6.—What will $23\frac{1}{3}$ dozen of French lace come to, at 2s. $11\frac{5}{6}$d. per yard?—*Ans.* £41 9s. $10\frac{1}{3}$d.

7.—If a yard of flowered lace cost 3s. $2\frac{9}{2}$d., what will $27\frac{1}{4}$ dozen come to?—*Ans.* £53 2s. $3\frac{1}{2}\frac{1}{2}$d.

8.—If a yard of fancy Brussels lace cost 9s. $10\frac{5}{6}$d, what will $47\frac{1}{4}$ dozen come to?—*Ans.* £280 2s. $0\frac{1}{1}\frac{1}{6}$d.

9.—What will $76\frac{3}{4}$ dozen of blond lace come to, at 9s. $5\frac{7}{2}$d. per yard?—*Ans.* £434 9s. $6\frac{1}{3}\frac{5}{2}$d.

10.—$127\frac{1}{3}$ dozen of fancy wrought lace, at 2s. $1\frac{1}{1}\frac{5}{6}$d. per yard?—*Ans.* £165 7s. $0\frac{3}{4}$d.

11.—$325\frac{1}{4}$ dozen of cambric lace, at 9s. $7\frac{1}{3}\frac{5}{2}$d. per yard?—*Ans.* £1876 15s. $10\frac{1}{3}\frac{5}{2}$d.

12.—$13\frac{1}{3}$ dozen of kid gloves, at 1s. $11\frac{3}{1}\frac{5}{6}$d. a pair?—*Ans.* £15 13s. $0\frac{3}{4}$d.

13.—$97\frac{1}{4}$ dozen of silk stockings, at 7s. $3\frac{1}{1}\frac{1}{6}$d. a pair?—*Ans.* £423 6s. $9\frac{1}{4}\frac{1}{6}$d.

14.—$143\frac{1}{3}$ dozen of cotton hose, at $7\frac{1}{3}\frac{1}{2}$d. per pair?—*Ans.* £52 12s. $7\frac{1}{2}$d.

PROBLEM I.

To find the price of a gross, the price of an article being given.

RULE.—Reckon the pence in the price of one article as shillings, and the number of pence in these shillings will be the price of a gross in shillings.

Reason.—Because, taking the pence in the price as shillings is the same as multiplying by twelve, and taking these shillings as pence again is the same as multiplying by twelve another time, and $12 \times 12 = 144 =$ one gross.

15.—One gross, at 4d. each?—*Ans.* 48s.

16.—One gross, at $2\frac{1}{2}$d. each?—*Ans.* 30s.

17.—One gross, at $3\frac{1}{4}$d. each?—*Ans.* 39s.

18.—One gross, at $7\frac{1}{4}$d. each?—*Ans.* 93s.

19.—One gross, at 8½d. each?—*Ans.* 99s.
20.—One gross, at 9½d. each?—*Ans.* 114s.
21.—One gross, at 11¾d. each?—*Ans.* 141s.
22.—One gross, at 12¼d. each?—*Ans.* 147s.
23.—One gross, at 13½d. each?—*Ans.* 162s.
24.—One gross, at 16½d. each?—*Ans.* 198s.
25.—One gross, at 19½d. each?—*Ans.* 231s.
26.—One gross, at 23¾d. each?—*Ans.* 285s.

PROBLEM 2.

By knowing the price of a gross, to find the price of a yard.

RULE.—Multiply the price of the gross by 10, subtract ¼ of the product, and you have the answer in farthings.

EXAMPLES.

27.—If a gross cost £1 1s., what will one yard cost?

£.	s.	
1	1	
	10	
¼ ÷ 10	10	
	3	10
7	0	= 7 far., or 1¾d. *Ans.*

28.—If a gross cost £2 2s., what will a yard cost?

£.	s.	
2	2	
	10	
¼ ÷ 21	0	
	7	0
14	0	= 14 far., or 3½d. *Ans.*

And so on of any other.

PROBLEM 3.

To find the price per score, the price of one being given.

RULE.—Call the shillings pounds, and then see what proportion the pence bears to the shillings, which you are to add to the shillings also for pounds.

EXAMPLES.

29.—Twenty pair of gold ear-rings, at 19s. 9d. per pair?—*Ans.* £19 15s.

Reason.—9d. = ¾ of a shilling—and 15s. = ¾ of a pound.

30.—Twenty yards of broad cloth, at 11s. 6d. the yard?—*Ans* £11 10s.
31.—Twenty volumes of Burn's poems, at 13s. 9d. a piece?—*Ans.* £13 15s.
32.—Twenty pairs of men's shoes, at 7s. 3d. the pair?—*Ans.* £7 5s.
33.—Twenty tea kettles, leaded, at 4s. 9d. each?—*Ans.* £4 15s.
34.—Twenty bibles, morocco binding, at 39s. 9d. a piece?—*Ans.* £39 15s.
35.—Twenty rosewood work-boxes, at 17s. 6d. a piece?—*Ans.* £17 10s.
36.—Twenty stones of white sugar, at 8s. 9d. per stone?—*Ans.* £8 15s.
37.—Twenty legs of mutton, at 13s. 6d. a leg?—*Ans.* £13 10s.
38.—Twenty bushels of apples, at 7s. 3d. a bushel?—*Ans.* £7 5s.
39.—Twenty sacks of flour, at £2 7s. 6d. a sack?—*Ans.* £47 10s.

40.—Forty table covers, at 12s. 6d. each?—*Ans.* £25.
41.—Sixty mahogany chairs, stuffed, at £1 2s. 9d. a piece?—*Ans.* £68 5s.
42.—Eighty counterpanes, cotton knap, at 12s. 2d. a piece?—*Ans.* £48 13s. 4d.
43.—One hundred silver tea spoons, at 11s. 4d. each?—*Ans.* £56 13s. 4d.
44.—One hundred and twenty bouquets of flowers, at 8s. 3d. each?—*Ans.* £49 10s.
45.—Twenty-five silk vests, at £1 2s. 9d. a piece?—*Ans.* £28 8s. 9d.
46.—Thirty pairs of trousers, at 16s. 3d. a pair?—*Ans.* £24 7s. 6d.
47.—Thirty-five pairs of short boots, at 11s. 3d. a pair?—*Ans.* £19 13s. 9d.
48.—Forty-five bonnets, at £1 6s. 8d. a piece?—*Ans.* £60.
49.—One hundred and forty-five flower stands, at 13s. 8d.?—*Ans.* £9 1s. 8d.
50.—Fifty-five pairs of silk stockings, at 12s. 7d. a pair?—*Ans.* £34 12s. 1d.
51.—One hundred and sixty sets of chess-men, at 9s. 3d. a set?—*Ans.* £74.
52.—Sixty-five yards of white silk, at 17s. 9d. per yard?—*Ans.* £57 13s. 9d.
53.—Seventy work-baskets, at 3s. 6d. each?—*Ans.* £12 5s.
54.—One hundred and eighty pairs of plated candlesticks, at 18s. 3d. per pair?—*Ans.* £164 5s.
55.—Seventy-five Britannia teapots, at 7s. 2d. each?—*Ans.* £26 17s. 6d.
56.—One hundred and forty French silk knaps, at £1 5s. 6d. each?—*Ans.* £178 10s.
57.—Ninety gold rings, at 13s. 4d. each?—*Ans.* 60.
58.—Two hundred yards of cambric lawn, at £1 4s. 5d. per yard?—*Ans.* £244 3s. 4d.
59.—Two hundred and twenty acres of land, at £1 7s. 6d. an acre; what is the yearly rent?—*Ans.* £302 10s.
60.—Thirty pounds, at 4s. per lb.?—*Ans.* £6.
61.—Fifty pounds, at 5s. 6d. per lb.?—*Ans.* £13 15s.
62.—Forty pounds, at 6s. 3d. per lb.?—*Ans.* £12 10s.
63.—Sixty pounds, at 2s. 3d. per lb.?—*Ans.* £6 15s.
64.—Eighty pounds, at 4s. 6d. per lb.?—*Ans.* £18.
65.—One hundred pounds, at 5s. 3d. per lb.?—*Ans.* £26 5s.
66.—Two hundred pounds, at 6s. per lb.?—*Ans.* £60.
67.—Two hundred pounds, at 5s. 6s. per lb.?—*Ans.* £55.
68.—Four hundred pounds, at 7s. 3d. per lb.?—*Ans.* £145.
69.—Six hundred pounds, at 9s. 9d. per lb.?—*Ans.* £292 10s.
70.—Eight hundred pounds, at 12s. per lb.?—*Ans.* £480.
71.—One thousand pounds, at 2s. 3d. per lb.?—*Ans.* £112 10s.

QUERY.

The price of a score being given, how do you find the price of one article?

PROBLEM 4.

To find the value of 100 *articles, the price of one being given.*

RULE.—For every farthing in the price, take as many pence, and twice as many shillings. Thus, 100 pencils, at 1½d. each, is 12s. 6d.—six being the number of farthings.

Reason.—Because, by taking a penny for every farthing, is the same as multiplying by four, and taking two shillings for every farthing, is the same as multiplying by ninety-six, and $96+4=100$.

EXAMPLES.

72.—One hundred oranges, at 2½d. each?—*Ans.* £1 0s. 10d.
73.—One hundred copy-books, at 4½d. each?—*Ans.* £1 17s. 6d.
74.—One hundred yards of toweling, at 5½d. per yard?—*Ans.* £2 3s. 9d.
75.—One hundred battens, at 1s. 7½d. a piece?—*Ans.* £8 0s. 5d.
76.—One hundred quarts of vinegar, at 1s. 3½d. a quart?—*Ans.* £6 1s. 3d.
77.—One hundred hearth brushes, at 2s. 3½d. a piece?—*Ans.* £11 7s. 1d.
78.—One hundred cakes of Windsor soap, at 9½d. a cake?—*Ans.* £4 1s. 3d.
79.—One hundred yards of mason work, at 5½d. a yard?—*Ans.* £2 7s. 11d.
80.—One hundred perches of sewering, at 3s. 7½d. per perch?—*Ans.* £18 2s 6d.
81.—One hundred cloth caps, at 19½d. each?—*Ans.* £8 0s. 5d.
82.—One hundred sticks of sealing wax, at 7½d. a stick?—*Ans.* £3 0s. 5d.
83.—One hundred China basons, at 7½d. a piece?—*Ans.* £3 4s. 7d.
84.—One hundred guard chains, at 7s. 6½d. a piece?—*Ans.* £37 16s. 3d.
85.—One hundred yards of silk twist, at 3s. 11½d. per yard?—*Ans.* £19 13s. 9d.
86.—One hundred gold watch chains, at 17s. 10d¼. each?—*Ans.* £89 5s. 5d.
87.—One hundred yards of silk binding, at 14½d. a yard?—*Ans.* £6 0s. 10d.
88.—One hundred gross of steel pens, at 13s. 9½d. the gross?—*Ans.* £69 1s. 3d.

PROBLEM 5.

By knowing the amount of 100, *to find the price of one.*

RULE.—To eight times the amount add one-fifth of itself, and the sum is the answer in farthings.

EXAMPLES.

89.—If 100 articles cost £2 18s. 4d., what is one worth?

£.	s.	d.
2	18	4
		8
5 ÷ 23	6	8
4	13	4

Ans. £28 0 0 = 28 far., or 7d.

90.—If 100 yards cost £5 16s. 8d. what will one cost?

£.	s.	d.
5	16	8
		8
5 ÷ 46	13	4
9	6	8

Ans. £56 0 0 = 56 far., or 14d.

91.—If 100 geese cost £11 13s. 4d., what is that a piece?

£.	s.	d.
11	13	4
		8
5 ÷ 93	6	8
18	13	4

Ans. £112 0 0 = 112f. or 2s. 4d.

92.—If 100 lbs. of tea cost £27 10s., what will one cost?

£.	s.	d.
27	10	0
		8
5 ÷ 220	0	0
44	0	0

Ans. £264 0 0 = 264 f. or 5s. 6d.

As the table of 12, with its component parts meet all calculations up to this stage, we now introduce to the student a new table, with the equation of 240, similarly constructed, which will prove of great utility, and may be carried on to infinity.

For 340	take	1 five-twelfth times....	240	For 700	take	2 eleven-twelfth times	240
.. 350	....	1 eleven-twenty-fourth.	240	.. 710	....	2 twenty-three-24th..	240
.. 360	....	1 one-half	240	.. 720	....	3	240
.. 370	....	1 thirteen-24th	240	.. 730	....	3 one-twenty-fourth ..	240
.. 380	....	1 seven-twelfth	240	.. 740	....	3 one-twelfth	240
.. 390	....	1 five-eighth	240	.. 750	....	3 one-eighth	240
.. 400	....	1 two-third	240	.. 760	....	3 one-sixth	240
.. 410	....	1 seventeen-24th	240	.. 770	....	3 five-twenty-fourth .	240
.. 420	....	1 one three-fourth	240	.. 780	....	3 one fourth	240
.. 430	....	1 nineteen-24th.....	240	.. 790	....	3 seven-24th	240
.. 440	....	1 five-sixth.....	240	.. 800	....	3 one-third	240
.. 450	....	1 seven-eighth	240	.. 810	....	3 three-eight	240
.. 460	....	1 eleven-twelfth	240	.. 820	....	3 five-twelfth	240
.. 470	....	1 twenty-three-24th....	240	.. 830	....	3 eleven-24th.....	240
.. 480	....	2	240	.. 840	....	3 one-half	240
.. 490	....	2 one-twenty fourth ..	240	.. 850	....	3 thirteen 24th.....	240
.. 500	....	2 one-twelfth	240	.. 860	....	3 seven-twelfth	240
.. 510	....	2 one-eighth	240	.. 870	....	3 five eighth	240
.. 520	....	2 one-sixth	240	.. 880	....	3 two-third.....	240
.. 530	....	2 five-twenty-fourth ..	240	.. 890	....	3 seventeen-24th	240
.. 540	....	2 one-fourth	240	.. 900	....	three-three-fourth ..	240
.. 550	....	2 seven-24th	240	.. 910	....	3 nineteen-24th	240
.. 560	....	2 one-third	240	.. 920	....	3 five-sixth	240
.. 570	....	2 three-eighth	240	.. 930	....	3 seven-eighth	240
.. 580	....	2 five-twelfth	240	.. 940	....	3 eleven-twelfth	240
.. 590	....	2 eleven-twenty-fourth.	240	.. 950	....	3 twenty-three-24th..	240
.. 600	....	2 one-half	240	.. 960	....	4	240
.. 610	....	2 thirteen-24th	240	.. 1000	....	4 one-sixth	240
.. 620	....	2 seven-twelfth.....	240	.. 1200	....	5	240
.. 630	....	2 five-eighth	240	.. 1440	....	6	240
.. 640	....	2 two-third	240	.. 1680	....	7	240
.. 650	....	2 seventeen-24th	240	.. 1920	....	8	240
.. 660	....	2 three-fourth	240	.. 2160	....	9	240
.. 670	....	2 nineteen-24th	240	.. 2400	....	10	240
.. 680	....	2 five-sixth	240	.. 2640	....	11	240
.. 690	....	2 seven-eighth	240	.. 2880	....	12	240

NOTE.—The pupil is recommended to get off the above by rote, as its object is to facilitate the progress of those who wish to become quick and expert calculators. The ingenious boy will see that the intermediate numbers between the tens can be found at once—that the system is general, and will answer any number proposed. This case also obviates the old Rule of Three system; a hateful remembrance to those who have spent years over it, and a terror to the tyro who has the dreary path before him.

EXERCISE II.

The price of one being given to calculate the amount of two hundred and forty, at any price.

RULE.—Call the pence which the unit costs pounds, and it is done. If a halfpenny, farthing, or three farthings be affixed to the pence, call the half-

penny ten shillings, and count five shillings for each farthing; if fractions be annexed, for $\frac{1}{8}$ take 2s. 6d; $\frac{1}{10}$, 2s.; $\frac{1}{12}$, 1s. 8d.; $\frac{1}{16}$, 1s. 3d.; $\frac{1}{32}$, 7½d.; $\frac{1}{64}$, 3¾d.; and $\frac{1}{128}$, 1⅞d.

Reason.—If a pound costs a penny, 240 lbs. will cost a pound. Hence, in general, as many pence as the pound costs, as many pounds will be the cost of 240 lbs; if 1 lb. costs a halfpenny, 240 lbs. will cost ten shillings; if a lb. costs a farthing, 240 lbs. will cost five shillings; if a yard costs $\frac{1}{8}$d., 240 yards will cost 2s. 6d.; for $\frac{1}{10}$, take 2s.; $\frac{1}{12}$, 1s. 8d.; $\frac{1}{16}$, 1s. 3d.; $\frac{1}{32}$, 7½d.; for $\frac{1}{64}$, take 3¾d.; $\frac{1}{128}$, 1⅞d. Therefore the rule is correct to call the pence pounds, the halfpenny ten shillings, and five shillings for each farthing, and in proportion for each fraction.

EXAMPLES.

1.—240 yards, at 19½d. per yard?—*Ans.* £19 5s.
2.—240 reams of paper, at 4s. 9d. per ream?—*Ans.* £57.
3.—240 lambs, at 7s. 7¾d per lamb?—*Ans.* £91 15s.
4.—240 yards of ribbon, at 1s. 1¾d. per yard?—*Ans.* £13 15s.
5.—240 lbs. of tea, at 5s. 9d$\frac{3}{4}$.?—*Ans.* £69 15s.
6.—240 lbs. of indigo, at 8s. 7½d. per lb.?—*Ans.* £103 10s.
7.—240 cwt. of Cheshire cheese, at £2 19s. 9½d. a cwt.?—*Ans.* £717 5s.
8.—240 silver forks, at 15s. 11¾d. per fork?—*Ans.* £191 15s.
9.—240 chased silver salvers, at 23s. 7½d. a piece?—£283 5s.
10.—240 quarters of oats, at 54s. 9½d per quarter?—*Ans.* £657 5s.
11.—240 firkins of butter, at 56s. 2¾d. per firkin?—*Ans.* 674 15s.
12.—240 cwt. of iron, at 15s. 11¼d. per cwt.?—*Ans.* £191 5s.
13.—240 roofing tiles, at 1s. 9¾d. a piece?—*Ans.* £21 15s.
14.—240 pairs of tweezers, at 1s. 11¼d. a pair?—*Ans.* £23 5s.
15.—240 gallons of brandy, at 16s. 9d. a gallon?—*Ans.* £201.
16.—240 tons of iron, at £13 10s. per ton?—*Ans.* £3240.
17.—240 yards of Brussels carpeting, at 7s. 11d. a yard?—*Ans.* £95.
18.—240 dozen of Flanders lace, at 3s. 8¾d. per dozen?—*Ans.* £44 15s.
19.—240 cwt. of Cheshire cheese, at £2 12s. 6d. per cwt.?—*Ans.* £630.
20.—240 yards of Yorkshire cloth, at 16s. 7¾d. per yard?—*Ans.* £199 15s.
21.—240 yards, at 3s. 7½d. per yard?—*Ans.* £43 2s. 6d.
22.—240 yards, at 5s. 9$\frac{1}{12}$d. per yard?—*Ans.* £69 1s. 8d.
23.—240 yards, at 7$\frac{3}{16}$d. per yard?—*Ans.* £7 3s. 9d.
24.—240 yards, at 3$\frac{1}{12}$d. per yard?—*Ans.* £3 0s. 7½d.
25.—240 yards of ribbon, at 2¾d. per yard?—*Ans.* £2 17s. 6d.
26.—240 yards of lace, at 3$\frac{3}{16}$d. per yard?—*Ans.* £3 3s. 9d.
27.—240 yards of fringe, at 2$\frac{3}{32}$d. per yard?—*Ans.* £2 1s. 10½d.
28.—240 yards of calico, at 5$\frac{1}{16}$d. per yard?—*Ans.* £5 16s. 3d.
29.—240 yards of silk, at 9$\frac{9}{32}$d. per yard?—*Ans.* £9 5s. 7½d.

PROBLEM 2.

To calculate for any number commensurate with 240.

RULE.—Call the pence which the integer costs pounds, the halfpenny ten shillings, and reckon a crown for each farthing, which multiply by the number of times the given number contains two hundred and forty; the result will be the amount.

What is the amount of each of the following commodities, at their respective prices per integer?

EXAMPLES.

30.—What are 480 yards worth, at 17¾d. per yard?

	£.	s.
	17	15
		2
Ans.	£35	10

31.—What are 720 lbs. worth, at 7½d. per lb.?—*Ans.* £21 15s.
32.—What are 960 stones of barley worth, at 10½d. per stone?—*Ans.* £42.
33.—What are 1200 lbs. of beef worth, at 4½d. per lb.?—*Ans.* £21 5s.
34.—What are 1440 lbs. of tobacco worth, at 3s. 9d. per lb.?—*Ans.* £270.
35.—What are 1680 lbs. of snuff worth, at 5s. 5½d. per lb.?—*Ans.* £458 10s.
36.—What are 1920 lbs. of mutton worth, at 7d. per lb.?—*Ans.* £56.
37.—What are 2160 yds. of linen worth, at 15¼d. per yd.?—*Ans.* £152 10s.

PROBLEM 3.

The amount of any number greater than 240, *but prime to it.*

RULE.—Call the pence, &c., which the integer costs pounds; then multiply by the number of times that 240 is contained in the given number: add the value of the prime part, and the sum will be the amount.

EXAMPLES.

38.—What is the amount of 247 stones of wheat, at 15¾d. per stone?

	£.	s.	d.		s.	d.
	15	15	0		1	3¾
	0	9	2¼			7
Ans.	£16	4	2¼		9	2¼

39.—967 lbs. of rice, at 4½d. per lb.?—*Ans.* £17 2s. 5¼d.
40.—1209 lbs. of sugar, at 6½d. per lb.?—*Ans.* £32 14s. 10½d.
41.—1199¾ lbs. of tea, at 5s. 5½d. per lb.?—*Ans.* £327 8s. 7⅝d.
42.—719½ lbs. of honey, at 2¾d. per lb.?—*Ans.* £11 4s. 10⅛d.

PROBLEM 4.

To calculate the amount of any aliquot part of 240, *at any price per integer.*

RULE.—Call the pence pounds, and take the aliquot part of 240 for the amount proposed.

EXAMPLES.

43.—What is the value of 20 stones of wheat, at 17¼d. per stone

	£.	s.	d.
	17	5	0
20 the one-twelfth	£1	8	9 *Ans.*

44.—30 lbs. of coffee, at 18d. per lb.?—*Ans.* £2 5s.
45.—40 pecks of oats, at 15½d. per peck?—*Ans.* £2 11s. 8d.
46.—48 stones of bran, at 10d. per stone?—*Ans.* £2.
47.—60 stones of flax, at 3s. 7½d. per stone?—*Ans.* £10 17s. 6d.
48.—80 stones of wool, at 11s. 11½d. per stone?—*Ans.* £47 18s. 4d.
49.—120 lambs, at 7s. 7¾d. per lamb?—*Ans.* £45 17s. 6d.

PROBLEM 5.

To find the value of any number less than 240, *so that the deficiency may be an aliquot part thereof.*

RULE.—From the price of the integer, written as pounds, take said part; then the excess of the cost of 240, above the cost of the part, will be the cost of the proposed number.

EXAMPLES.

50.—What is the value of 160 stones of wheat, at 15d. per stone?

£15, the cost of 240.
One-third 5, the cost of 80, the deficiency.

£10, value of the proposed number.

51.—180 lbs. of beef, at 4½d. per lb.?—*Ans.* £3 7s. 6d.
52.—200 lbs. of iron, at 2½d. per lb.?—*Ans.* £1 17s. 6d.
53.—220 lbs. of sugar, at 6½d. per lb.?—*Ans.* £5 19s. 2d.
54.—210 lbs. of coffee, at 1s. 8d. per lb.?—*Ans.* £17 10s.

PROBLEM 6.

The amount of any number greater than 240, *so that the excess may be an aliquot part thereof.*

RULE.—Write the pence as pounds, to which add such part of the same, as the excess is of 240; the sum will be the amount.

EXAMPLES.

55.—What is the value of 260 lbs. of madder, at 2s. 7½d. per lb.?

	£.	s.	d.	
	31	10	0	the price of 240.
20 is one-twelfth	2	12	6	the price of 20.
	£34	2	6	*Ans.*

56.—What are 270 lbs. worth, at 13½d. per lb.?—*Ans.* £15 3s. 9d.
57.—What are 280 lbs. worth, at 9½d. per lb.?—*Ans.* £10 15s. 10d.
58.—What are 300 lbs. worth, at 11½d. per ib.—*Ans.* £14 1s. 3d.
59.—What are 320 lbs. worth, at 8½d. per lb.?—*Ans.* £11 13s. 4d.
60.—What are 360 lbs. worth, at 15½d. per lb.?—*Ans.* £23 12s. 6d.
61.—What are the price of 400 lbs. of cheese, at 1¾d. per pound?—*Ans.* £2 18s. 4d.
62.—What are 420 lbs. worth, at 15½d. per lb.?—*Ans.* £27 2s. 6d.
63.—What are 440 yards worth, at 9½d. per yard?—*Ans.* £16 19s. 2d.

64.—What are 460 ounces worth, at 11½d. per ounce?—*Ans.* £22 0s. 10d.
65.—What are 480 stones worth, at 10½d. per stone?—*Ans.* £20 10s.
66.—What are 500 stonse worth, at 10¾d. per stone?—*Ans.* £22 7s. 11d.
67.—What are 520 yards worth, at 6½d. per yard?—*Ans.* £14 1s. 8d.
68.—What are 540 stones worth, at 17d. per stone?—*Ans.* £38 5s.
69.—What are 560 lbs. worth, at 11¼d. per lb.?—*Ans.* £26 5s.
70.—What are 600 lbs. worth, at 18¼d. per lb.?—*Ans.* £46 17s. 6d.
71.—What are 640 lbs. of soap worth, at 7¼d.—*Ans.* £19 6s. 8d.
72.—What are 600 lbs. of loaf sugar worth, at 10½d. per lb.?—*Ans.* £26 5s.
73.—What are 680 lbs. of raisins worth, at 9½d. per lb.?—*Ans.* £26 4s. 2d.
74.—What are 700 lbs. of tea worth, at 3s. 9½d. per lb.?—*Ans.* £132 14s. 2d.
75.—What are 720 lbs. of ginger worth, at 5½d. per lb.?—*Ans.* £16 10s.
76.—What are 740 lbs. worth, at 41d. per lb.?—*Ans.* £126 8s. 4d.
77.—What are 760 lbs. worth, at 18½d. per lb.?—*Ans.* £58 11s. 8d.
78.—What are 780 lbs. worth, at 17d. per lb.?—*Ans.* £55 5s.
79.—What are 800 lbs. worth, at 19d. per lb.?—*Ans.* £63 6s. 8d.

This mode of calculation may be carried as far as you please. It is evident how any odd number may be computed: it is only requisite to find the amount of the even part, as is already shown, to which add the value of the prime part, and you have the total.

PROBLEM 7.

To calculate the amount of 240, *or any number commensurate with* 240, *at pounds, shillings, pence, farthings, &c., per integer.*

RULE.—First, find for 240, at so many pounds; then for the shillings, pence, farthings, fractions, &c.: all these sums added will give the amount required.

EXAMPLE.

80.—What is the value of 240 lbs. of green tea, at £1 7s. 7½. per lb.?

	£	s.	d.				
240 at	1	0	0	=	240	0	
240 at	0	7	0	=	84	0	
240 at	0	0	7	=	7	0	
240 at	0	0	0½	=	0	10	
					£331	10	*Ans.*

EXPLANATION.

240 lbs., at one pound, will be two hundred and forty pounds; 240 lbs., at seven shillings per lb., will be eighty-four pounds; 240 lbs., at sevenpence per lb., will be seven pounds; and 240 lbs., at one halfpenny per lb., will be ten shillings; making in all £331 10s.

To impress this more forcibly on the mind, let the following questions be solved by the same peculiar artifice.:—

81.—720 sheep, at £2 13s. 7d. each?—*Ans.* £1929.
82.—480 yards of cloth, at £1 13s. 7½d. per yard?—*Ans.* £807.
83.—360 ounces of gold, at £3 8s. 4½d. per ounce?—*Ans.* £1230 15s.
84.—960 cwt. of sugar, at £2 11s. 4d. per cwt.?—*Ans.* £2464.
85.—1200 lambs, at 11s. 7d. each?—*Ans.* £695.
86.—1440 gallons of brandy, at £1 3s. 9d. per gallon?—*Ans.* £1710.
87.—1680 quarters of wheat, at £2 12s. 7d. per quarter?—*Ans.* £4417.
88.—1920 quarters of barley, at £2 1s. 10d. per quarter?—*Ans.* £4016.
89.—2400 yards of silk, at £3 1s. 7d. per yard?—*Ans.* £7390.
90.—2880 ounces of gold, at £4 15s. 10d. per oz.?—*Ans.* £13800.
91.—1784¼ lbs. of silver, at £3 5s. 9d. per lb.?—*Ans.* £5866 10s. 10½d.
92.—1873½ cwt. of tallow, at £2 13s. 5d. per cwt.?—*Ans.* £5003 2s. 9½d.
93.—1381¾ cwt. of sugar, at £2 9s. 10d. per cwt.?—*Ans.* £3442 17s. 2½d.

NOTE.—If the number proposed be odd, first find the amount of the even part, to which add the value of the odd number.

PROBLEM 7.

To compute any quantity in whole numbers, at an integral number of shillings per integer.

RULE.—Multiply the proposed number by half the price, when even, or by half the greatest even number contained therein; when odd, double the unit's figure of the product for shillings, the remainder will be pounds; but for the odd part, add its amount, at a shilling per integer.

EXAMPLE.

94.—At 13s. per yard, what is the value of 83 yards?

83 yards
6

49 16 at 12s.
83s. are 4 3

£53 19 *Ans.*

95.—270 yards, at 2s. per yard?—*Ans.* £27.
96.—650 lbs. of tea, at 4s. per lb.?—*Ans.* £130.
97.—640 yards of silk, at 6s. per yard?—*Ans.* £192.
98.—572 yards of velvet, at 8s. per yard?—*Ans.* £228 16s.
99.—673 yards, at 10s. per yard?—*Ans.* £336 10s.
100.—763 yards, at 12s. per yard?—*Ans.* £457 16s.
101.—656 yards, at 14s. per yard?—*Ans.* £459 4s.
102.—873 gallons, at 16s. per gallon?—*Ans.* £698 8s.
103.—875 cwt., at 18s. per cwt.?—*Ans.* £787 10s.

Reason.—There are six twos contained in the greatest even number in 13, and when 83 is multiplied by 6, it produces 498 twos, the tenth of which will be pounds; but its tenth is the whole product of the units' figure, which is multiplied by two, producing shillings, being the same in effect as multiplying it by 20, and dividing the result by 10.

THE weight of wool varies in different places; and the author thinks it but justice to both buyer and seller, to give the following table according to custom and denomination, with a few examples in each case, which will render the calculation familiar under any head:—

TABLE OF THE WEIGHTS OF WOOL.

General Weights.	*In some parts of England,*
7 pounds .....make.....1 clove.	15 pounds .....make.....1 stone.
2 cloves, or 14 lbs. .....1 stone.	2 stones, or 30 lbs. .....1 tod.
2 stones, or 28 lbs. .....1 tod.	8 tods, or 240 lbs. .....1 pack.
6½ tods.....1 wey.	In Ireland, 16 lbs. make ...1 stone.

PROBLEM 1.

Having the price per lb., to find the price per stone of 14 *lbs.*

RULE.—Call the pence shillings, and to that sum add one-sixth of itself, and you have the result.

EXAMPLES.

1.—If a pound of wool cost 17d., what is the cost of a stone?

d.	s.	d.
17 =	17	0
⅙	2	10
Ans.	19	10

2.—If a pound cost 23½d., what will a stone come to?—*Ans.* £1 7s. 5d.
3.—If a lb. cost 3s. 9½d., what is a stone worth?—*Ans.* £2 13s. 4½d.
4.—If a lb. cost 5s. 6½d., what will a stone come to?—*Ans.* £3 17s. 3½d.

PROBLEM 2.

Having the price per lb., to know the price per stone of 15 *lbs.*

RULE.—Call the pence, &c., which the lb. costs, shillings, to which add one-fourth of itself, and you have the amount per stone; and as 16 lbs. make a stone in Ireland, call the pence also shillings, to which add one-third of itself, and you have the amount for a stone of 16 lbs.

Reason.—In either of the above cases, when you call the pence shillings, you have the value of 12 lbs., and when you add the one-sixth, you have the amount of a stone of 14 lbs.; the one-fourth, you have the value of a stone of 15 lbs.; the one-third, you have the value of a stone of 16lbs.

EXAMPLES OF 15 LBS.

5.—What will a stone of 15 lbs. come to at 2s. 1¾d. per lb.

s.	d.	£.	s.	d.
2	1¾ =	1	5	9
One-fourth		0	6	5¼
Ans.		£1	12	2¼

6.—If 1 lb. cost 13½d., what will a stone come to?—*Ans.* 16s. 10½d.
7.—If a lb. cost 2s. 7½d., what will 7 stone come to?—*Ans.* £13 13s. 5½d.
8.—If a lb. cost 1s. 9½d., what will 9 stone come to?—*Ans.* £12 1s. 10½d.
9.—If a lb. cost 3s. 1½d., what cost 11 stone?—*Ans.* £25 15s. 7½d.
10.—What will 12 stone come to, at 3s. 7½d. per lb.?—*Ans.* £32 0s. 6d.

EXAMPLES OF 16 LBS.

11.—What will a stone come to, at 2s. 5½d. per lb.?

s.	d.	£.	s.	d.
2	5½	=1	9	6
One-third		0	9	10
Ans.		£1	19	4

12.—If 1 lb. cost 17¾d., what cost a stone?—*Ans.* £1 3s. 8d.
13.—If 1 lb. cost 13½d., what cost 1 stone?—*Ans.* 18s.
14.—If 1 lb. cost 16½d., what cost a stone?—*Ans.* £1 1s. 8d.
15.—If 1 lb. cost 2s. 10½d., what is a stone worth?—*Ans.* £2 5s. 8d.
16.—If 1 lb. cost 3s. 3¾d., what will 9 stone come to?—*Ans.* £23 17s.
17.—If 1 lb. cost 4s. 7½d., what will 12 stone cost?—*Ans.* £44 4s.

NOTE.—A pack of wool contains 240 lbs., consequently a pack of 15 lbs. to the stone contains 16 stones; a pack of 16 lbs to the stone contains 15 stones: so by either pack, stone, or lb., you have the result instantaneously, at any proposed price per pack, per stone, or per lb.

PROBLEM 3.

By having the price of a lb., to know the amount per pack.

RULE.—Call the pence which a lb. costs pounds, the half-penny ten shillings, and each farthing five shillings, and you have the amount per pack; and as often as 240 is contained in any number, so many times the pence of one will be the amount required.

EXAMPLES.

18.—1 pack of wool, at 15¾d. per lb.?—*Ans.* £15 15s.
19.—1 pack of wool, at 17½d. per lb.?—*Ans.* £17 10s.
20.—1 pack of wool, at 13¼d. per lb.?—*Ans.* £13 5s.
21.—1 pack of wool, at 14½d. per lb.?—*Ans.* £14 10s.
22.—2 packs of wool, at 15¾d. per lb.?—*Ans.* £31 10s.
23.—3 packs of wool, at 17½d. per lb.?—*Ans.* £51 15s.
24.—4 packs of wool, at 16¾d. per lb.?—*Ans.* £67.
25.—5 packs of wool, at 18½d. per lb.?—*Ans.* £91 5s.
26.—7 packs of wool, at 23¾d. per lb.?—*Ans.* £166 5s.
27.—11 packs of wool, at 21½d. per lb.?—*Ans.* £236 10s.
28.—12 packs of wool, at 25¾d. per lb.?—£309.

NOTE.—The calculation of feathers, bran, or barley, is the same, because each of these standards contain as many integers of its own denomination as a stone of wool contains pounds.

Reason.—When you estimate a stone at a pound, it will be worth 1s. 3d. for 16 lbs.; 1s. 4d. for 15 lbs.; and 1s. 5¼d. for 14 lbs.

EXERCISE III.

THE CALCULATION OF WHEAT.

PROBLEM 1.

Knowing the price per stone, to find the amount per barrel.

RULE.—Call the pence which the stone costs pounds, and its one-twelfth will be the amount per barrel.

Reason.—When you write the pence as pounds, you have the amount of 240, the one-twelfth of which will be the value of 20 stones, or one barrel.

EXAMPLE.

1.—At 15½d. per stone of wheat, what is that per barrel?

	£.	s.	d:
	15	10	0
Ans.—20 is one-twelfth,	£1	5	10

PROBLEM 2.

Having the amount per barrel, to know the price per stone.

RULE.—Multiply the price per barrel in shillings by 3, and divide the product by 5, the quotient will be the price of the stone in pence.

EXAMPLE.

2.—At 35s. per barrel, what is that per stone?

s.
35
3

5 ÷ 105

Ans. 21d. per stone.

Proof.—5s. is the price of a barrel, at 3d. per stone, and 7 times 5 make 35s., the amount of the barrel; therefore the analogy is correct.

3.—18 bushels, at 5s. 4d. per bushel?—Ans. £4 16s.
4.—26 bushels, at 4s. 10½d. per bushel?—Ans. £6 6s. 9d.
5.—31 bushels, at 6s. 3½d. per bushel?—Ans. £9 14s. 4½d.
6.—37 bushels, at 7s. 5½d. per bushel?—Ans. £13 16s. 8½d.
7.—15 quarters, at £2 1s. 9d. per quarter?—Ans. £31 6s. 3d.
8.—19 quarters, at £2 12s. 7d. per quarter?—Ans. £49 19s. 1d.
9.—23 quarters, at £2 9s. 3d. per quarter?—Ans. £56 12s. 9d.
10.—31 quarters, at £2 11s. 10d. per quarter?—Ans. £80 6s. 10d.
11.—37 quarters, at £1 19s. 11d. per quarter?—Ans. £73 16s. 11d.

CALCULATION OF FLOUR.

PROBLEM 3.

To calculate for any number of stones or bags, at any price per stone, per bag, &c.

RULE.—Call the pence which a stone costs shillings, the shillings and pence which a bag costs pounds, and calculate on the general principle by the equation of 12 and 240, as before.

12.—13 stones of flour, at 1s. 3d. per stone?—Ans. 16s. 3d.
13.—14 stones of flour, at 1s. 4d. per stone?—Ans. 18s. 8d.
14.—15 stones of flour, at 1s. 5½d. per stone?—Ans. £1 1s. 10½d.
15.—17 stones of flour, at 1s. 6¼d. per stone?—Ans. £1 5s. 10¼d.
16.—18 stones of flour, at 1s. 11½d. per stone?—Ans. £1 15s. 3d.
17.—19 stones of flour, at 2s. 3¾d. per stone?—Ans. £2 3s. 11¼d.
18.—20 bags of flour, at 27s. 9d. per bag?—Ans. £27 15s.
19.—30 bags of flour, at 29s. 3d. per bag?—Ans. £43 17s. 6d.
20.—40 bags of flour, at 31s. 7d. per bag?—Ans. £63 3s. 4d.
21.—60 bags of flour, at 32s. 3d. per bag?—Ans. £96 15s.
22.—80 sacks of flour, at 35s. 10d. per sack?—Ans. £143 6s. 8d.

PROBLEM 4.

To calculate the amount of any number of barrels, stones, and lbs., at any price per barrel or stone.

RULE.—Call the barrels pounds, the stones shillings, and the six-seventh of the lbs. pence, and it will be the amount at one pound per barrel: if the price be more, add; if less, subtract proportionably of a pound.

EXAMPLE.

23.—What is the amount of 12 barrels, 13 stones, 7 lbs., at £1 10s. per barrel?

	£.	s.	d.	
	12	13	6,	the amount at a pound, per rule.
One half,	6	6	9,	the amount at 10s.
Ans.	£19	0	3	

PROBLEM 5.

Having the price of a stone, to calculate the amount of the barrel of 40 stones.

RULE.—Call the pence per stone pounds, &c., the one-sixth thereof will be the amount.

EXAMPLE.

24.—At 18¾d. per stone of wheat, what is that per barrel of 40 stones? £18 15s. its one-sixth, is £3 2s. 6d. per barrel, as required.

PROBLEM 6.

Having the price per stone, to know the amount per barrel containing sixty-four stones.

RULE.—To the farthings, which one stone costs, add one-third for the price of the barrel in shillings.

EXAMPLE.

25.—At 5¾d. per stone, what will 64 stones cost?

23 farthings.
One-third 7s. 8d.

Ans. 30s. 8d. per barrel.

PROBLEM 7.

To calculate the amount of the barrel, containing 100 *stones.*

RULE.—Multiply two and a penny by the farthings per stone, the product will be the amount.

EXAMPLE.

26.—At 2¼d. per stone, what is the value of 100 stones?

Multiplying 2s. 1d. by 9, produces 18s. 9d., the answer.

To reverse this rule.

Multiply the price of the barrel by 12; the one-twenty-fifth of the product in pounds will be the price per stone in farthings.

EXERCISE IV.

THE CALCULATION OF OATS.

PROBLEM 1.

By having the price of a stone, to know the amount per barrel.

RULE.—Call the pence which the stone costs shillings, the halfpenny sixpence, and write threepence for each farthing, to which add its one-sixth for the price of a barrel.

Reason.—When you write the price of a stone in pence as shillings, you have the value of 12 stones; and when you add its one-sixth thereto, you have the value of 14 stones—the small barrel of oats.

EXAMPLE.

1.—At 14¾d. per stone, what is it per barrel?

	s.	d.
	14	9
2 is one-sixth,	2	5½
Ans.	17	2½

PROBLEM 2.

To calculate the amount of any number of barrels, stones, or lbs., at any price per barrel.

RULE.—Allow fourteen shillings per barrel, one shilling per stone, and six-sevenths of a penny per pound: then, if the price be more, add; if less, subtract proportionably.

EXAMPLE.

2.—At 10s. 6d. per barrel, what is the amount of 10 barrels, 12 stones 7 lbs?

s.	d.
14	0
10	6
3	6

	bar.	st.	lbs.	£.	s.	d.
Per rule,	10	12	7 = 7		12	6
3s. 6d. one-fourth,				1	18	1½
Ans.				£5	14	4½

PROBLEM 3.

Having the price of a barrel, to know the amount per stone.

RULE.—From the price of the barrel in shillings, deduct its one-seventh; the remainder will be the price of the stone in pence.

EXAMPLE.

3.—At 14s. per barrel, what is that per stone?

	s.
	14
One-seventh,	2
Ans.	12 pence per stone.

4.—20 quarters of oats, at 33s. 9d. per quarter?—Ans. £33 15s.
5.—27 quarters of oats, at 41s. 3d. per quarter?—Ans. £55 13s. 9d.
6.—33 quarters of oats, at 37s. 10d. per quarter?—Ans. £62 8s. 6d.
7.—37 quarters of oats, at 38s. 7d. per quarter?—Ans. £71 7s. 7d.
8.—47 quarters of oats, at 39s. 11d. per quarter?—Ans. £93 16s. 1d.
9.—49 quarters of oats, at 43s. 8d. per quarter?—Ans. £106 19s. 8d.

EXERCISE V.

THE CALCULATION OF LAND.

PROBLEM 1.

By having the price of a perch, to know the amount per acre.

RULE.—Write the price of a perch in pence as pounds, and from it deduct its one-third; the remainder will be the amount of the acres in pounds.

EXAMPLE.

1.—At 15½d. per perch, what is that per acre?

	£.	s.	
	15	15,	the amount of 240.
One-third,	5	5	
Ans.	£10	10,	the amount of 160 perches.

PROBLEM 2.

By having the price per perch, to know the amount per rood.

RULE.—Call the pence which the perch costs pounds, and the one-sixth thereof will be the amount per rood.

EXAMPLE.

2.—At 6d. per perch, what is that per rood?

One-sixth, £6, the amount of 240.

Ans. £1, the amount of 40 perches, or a rood.

PROBLEM 3.

To calculate the amount of any number of acres, roods, and perches.

RULE.—Call the acres pounds, five times the roods shillings, and three times the perches halfpence, which will be the amount at one pound per acre: then, if the price per acre be more, add; if less, subtract proportionably of a pound.

EXAMPLE.

3.—What is the rent per annum of 35 acres, 3 roods, 20 perches, at £1 5s. per acre?

	£.	s.	d.	
	35	17	6	at a pound, per rule.
¼	8	19	4½	at a crown.
	£44	16	10½	amount.

Reason.—Allow a pound per acre, and estimate the rood and perch in proportion.

PROBLEM 4.

By having the price per acre, to know the amount per perch.

RULE.—To the price of the acre in pounds, add its half, and call the sum the price of the perch in pence.

EXAMPLE.

4.—At £6 per acre, what is that a perch?

	£6
½	3
Ans.	9d. per perch.

PROBLEM 5.

To reduce Irish miles to English.

RULE.—To the Irish miles add four times the same, and lack a figure to the right, the one-eleventh of the sum will be English miles; and the reverse, to the English add the same, lacking a figure to the right, the one-seventh of half the sum will be Irish miles.

PROBLEM 6.

To reduce plantation to statute acres.

RULE.—Double the Irish acres, and from it take twice the double, lacking two figures to the right; the one one-hundred-and-twenty-first part of the remainder will be statute acres.

EXAMPLE.

5.—In 484 Irish acres, how many English?

968
1936

121 ÷ 94864

Ans. A. 784 English, per rule the first.

PROBLEM 7.

To reduce English to Irish acres, or statute to plantation.

RULE.—To the English acres add twelve times the same, keeping one figure to the left: the one-forty-ninth of the sum will be roods in plantation measure.

EXAMPLE.

6.—In 784 English acres, how many plantation acres?

3920
47040

474320
$\frac{1}{49}$ 9680

Ans. 484.000 = 484 acres.

PROBLEM 8.

To multiply acres, roods, and perches by acres, roods, and perches.

RULE.—Acres, multiplied by acres, produce acres; acres, multiplied by roods, produce roods; acres, multiplied by perches, produce perches; roods, multiplied by roods, the one-fourth of the product is roods; roods, multiplied by perches, the one-fourth of the product is perches; perches, multiplied by perches, the one-hundred-and-sixtieth of the product is perches.

EXAMPLE.

7.—Multiply 12A. 3R. 16P. by 7A. 2R. 20P.—Ans. 94.A. 1R. 22P.

EXERCISE VI.

COMPENDIUMS IN AVOIRDUPOIS WEIGHT.

NEW TABLE: HAVING THE PRICE PER LB., TO KNOW THE AMOUNT PER CWT., FROM ONE FARTHING TO THREE SHILLINGS AND SIXPENCE.

℔ lb.	℔ cwt.	℔ lb.	℔ cwt.	℔ lb.	℔ cwt.	℔ lb.	℔ cwt.
D. £. S. D.		D. £. S. D.		D. £. S. D.		D. £. S. D.	
¼ is 0 2 4		6 is 2 16 0		11¼ is 5 9 8		20 is 9 6 8	
½ ... 0 4 8		6¼ ... 2 18 4		12 ... 5 12 0		21 ... 9 16 0	
¾ ... 0 7 0		6½ ... 3 0 8		12¼ ... 5 14 4		22 ...10 5 4	
1 ... 0 9 4		6¾ ... 3 3 0		12½ ... 5 16 8		23 ...10 14 8	
1¼ ... 0 11 8		7 ... 3 5 4		12¾ ... 5 19 0		24 ...11 4 0	
1½ ... 0 14 0		7¼ ... 3 7 8		13 ... 6 1 4		25 ...11 13 4	
1¾ ... 0 16 4		7½ ... 3 10 0		13¼ ... 6 3 8		26 ...12 2 8	
2 ... 0 18 8		7¾ ... 3 12 4		13½ ... 6 6 0		27 ...12 12 0	
2¼ ... 1 1 0		8 ... 3 14 8		13¾ ... 6 8 4		28 ...13 1 4	
2½ ... 1 3 4		8¼ ... 3 17 0		14 ... 6 10 8		29 ...13 10 8	
2¾ ... 1 5 8		8½ .. 3 19 4		14¼ ... 6 13 0		30 ...14 0 0	
3 ... 1 8 0		8¾ ... 4 1 8		14½ ... 6 15 4		31 ...14 9 4	
3¼ ... 1 10 4		9 ... 4 4 0		14¾ ... 6 17 8		32 ...14 18 8	
3½ ... 1 12 8		9¼ ... 4 6 4		15 ... 7 0 0		33 ...15 8 0	
3¾ ... 1 15 0		9½ ... 4 8 8		15¼ ... 7 4 8		34 ...15 17 4	
4 ... 1 17 4		9¾ ... 4 11 0		16 ... 7 9 4		35 ...16 6 8	
4¼ ... 1 19 8		10 ... 4 13 4		16¼ ... 7 14 0		36 ...16 16 0	
4½ ... 2 2 0		10¼ ... 4 15 8		17 ... 7 18 8		37 ...17 5 4	
4¾ ... 2 4 4		10½ ... 4 18 0		17¼ ... 8 3 4		38 ...17 14 8	
5 ... 2 6 8		10¾ ... 5 0 4		18 ... 8 8 0		39 ...18 4 0	
5¼ ... 2 9 0		11 ... 5 2 8		18¼ ... 8 12 8		40 ...18 13 4	
5½ ... 2 11 4		11¼ ... 5 5 0		19 ... 8 17 4		41 ...19 2 8	
5¾ ... 2 13 8		11½ ... 5 7 4		19¼ ... 9 2 0		42 ...19 12 0	

PROBLEM 1.

The price of a drachm in farthings, to find the value of lbs.

RULE. Multiply the price of a drachm, in farthings, by sixteen, and that product by the number of lbs.; double the first figure for shillings, then divide by six: the quotient will be pounds, shillings, and pence.

EXAMPLES.

1.—At 3¼d. the drachm, what cost 8 lbs.?

13
16
208
8
6 ÷ 166 8s.

Ans. £27 14s. 8d.

2.—At 4½d. the drachm, what cost 68 lbs.?—Ans. £326 8s.

PROBLEM 2.

To find the value of a pound, the price per ounce being given.

RULE.—If it be a pound avoirdupois, divide the farthings in the price per ounce by three, for the answer in shillings; if it be a pound troy, divide by four.

Reason.—By taking the farthings as shillings, is multiplying by 48: now $48 \div 3 = 16$ oz. in a pound avoirdupois; and $48 \div 4 = 12$ lb. troy.

EXAMPLES.

3.—1 lb. avoirdupois, at 1½d. per ounce?—Ans. 2s.
4.—1 lb. avoirdupois, at 2d. per ounce?—Ans. 2s. 8d.
5.—1 lb. avoirdupois, at 3d. per ounce?—Ans. 4s.
6.—1 lb. avoirdupois, at 5d. per ounce?—Ans. 6s. 8d.
7.—1 lb. avoirdupois, at 7½d. per ounce?—Ans. 10s.
8.—1 lb. avoirdupois, at 10¾d. per ounce?—Ans. 14s. 4d.
9.—1 lb. troy, at 4d. per ounce?—Ans. 4s.
10.—1 lb. troy, at 2½d. per ounce?—Ans. 2s. 6d.
11.—1 lb. troy, at 6¾d. per ounce?—Ans. 6s. 9d.
12.—1 lb. troy, at 7¼d. per ounce?—Ans. 7s. 3d.
13.—1 lb. troy, at 11¾d. per ounce?—Ans. 11s. 9d.

PROBLEM 3.

To find the value of a cwt. the price per pound being given in pence.

RULE.—Take nine times as many shillings, and four times as many pence, as there are pence in the price per pound.

Reason.—Because, 9s. 4d. = 112d.

EXAMPLES.

14.—1 cwt. at 2d. per pound?—Ans. 18s. 8d.
15.—1 cwt. at 3d. per pound?—Ans. 28s.
16.—1 cwt. at 6d. per pound?—Ans. 56s.
17.—1 cwt. at 4d. per pound?—Ans. 37s. 4d.
18.—1 cwt. at 5d. per pound?—Ans. 46s. 8d.
19.—1 cwt. at 7d. per pound?—Ans. 65s. 4d.
20.—1 cwt. at 8d. per pound?—Ans. 74s. 8d.
21.—1 cwt. at 9d. per pound?—Ans. 84s.
22.—1 cwt. at 10d. per pound?—Ans. 93s. 4d.
23.—1 cwt. at 11d. per pound?—Ans. 102s. 8d.
24.—1 cwt. at 12d. per pound?—Ans. 112s.

PROBLEM 4.

Having the price of an ounce in farthings, to find the price of 112 *lbs.*

RULE.—Multiply the number of pounds by the price of one ounce in farthings, double the first figure for shillings, and divide by six for the answer.

EXAMPLES.

25.—At 4½d. the ounce, what cost 112 lbs. of tea?

lbs.
112
17

6 ÷ 190 8

Ans. £31 14 8

26.—At 8½d. the ounce, what cost 224 lbs.—Ans. £126 18s. 8d.
27.—At 7½d. the ounce, what cost 346 lbs.—Ans. £178 15s. 4d.

PROBLEM 5.

Having the price of one hundred and twelve pounds, to find the value of an ounce.

RULE.—Multiply the price of a hundred and twelve pounds by 5, divide the product by 7, and one quarter of that sum subtracted from itself is the answer in farthings.

EXAMPLES.

28.—If 112 lbs. of tea cost £31 14s. 8d., what is it an ounce?

	£.	s.	d.
	31	14	8
			5
7 ÷	158	13	4
One quarter	22	13	4
	5	13	4
Farthings	17	0	0 = 4¼d. Ans.

29.—If 1 cwt. of tobacco cost £35 9s. 6d., what is that per ounce?—Ans. 4¾d.
30.—Bought 112 lbs. of coffee for £9 6s. 8d.; what was it an ounce?—Ans. 1¼d.

PROBLEM 6.

The value of any number of cwts. at pence per ounce.

RULE.—Multiply the pence per oz. by the cwts., and with the product considered as pence, take parts of 1792, the number of oz. in 112 lbs.

EXAMPLES.

31.—What will 6 cwt. come to, at 5d. per ounce?

6
5

30 = 2s. 6d., and 2s. 6d. is ⅛ of 1792

£224 Ans.

32.—What will 10 cwt. come to, at 4d. per oz.

10
4
—
40=3s. 4d., and 3s. 4d. is $\frac{1}{6}$ of 1792

Ans. £298 13s. 4d.

33.—What will 8 cwt. come to, at 3d. per oz.?

8
3
—
24=2s., and 2s. is $\frac{1}{10}$ of 1792

£179 4s. Ans.

34.—What will 12 cwt. come to, at 4d. per oz.?

12
4
—
48=4s., and 4s. is $\frac{1}{5}$ of 1792

£358 8s. Ans.

35.—What will 16 cwt. come to, at 3¼d. per oz.?

16
3¼
—
5=5s., and 5s. is $\frac{1}{4}$ of 1792

£448 Ans.

36.—What will 24 cwt. come to, at 3½d. per oz.?

24 £. s.
—
7 and 1792s.= 89 12
7

£627 4 Ans.

37.—What will 12 cwt. come to, at 15d. per oz.?

12
15
—
180=15s., $\frac{1}{4}$ of 1792
448 off

£1344 Ans.

LONG WEIGHT.

PROBLEM 7.

Having the price of one hundred and twenty pounds, to find the price of an ounce.

RULE.—Divide the price of one hundred and twenty by two: the quotient will be the answer in farthings.

EXAMPLES.

38.—If 120 lbs. cost £60, what will 1 oz. cost?

£.
2÷60

Ans. 30 far. = 7½d.

39.—If 120 lbs. cost £80, what is 1 oz. worth at that rate?

£.
2÷80

Ans. 40 far. = 10d.

PROBLEM 8.

Knowing the price of one pound in farthings, to find the price of 112 *lbs.*

RULE.—Write down the farthings which one pound costs; double the unit's figure for shillings; add one-sixth of itself, and you have the answer.

EXAMPLES.

40.—If 1 lb. of sugar cost 4½d., what cost 112 lbs.?

	farthings.
	18
	2
⅙÷1	16
	0 6
Ans.	£2 2

41.—If 1 lb. of loaf sugar cost 9¾d. what cost 1 cwt.?

	farthings.
	39
	2
⅙÷3	18
	0 13
Ans.	£4 11

PROBLEM 9.

Having the price per pound, to know the amount per quarter.

RULE.—Seven times the price of a pound in pence, will be the price per quarter in groats; or multiply two shillings and fourpence by the price of a pound in pence, for the price of the quarter.

EXAMPLE.

42.—At 4d. per pound, what is that per quarter or 28 lbs.?

d.		s. d.
4	or	2 4
7		4
28 groats, or 112d. = 9s. 4d.		9 4 Ans.

PROBLEM 10.

The value of cwts., quarters, and pounds, at any price per pound.

RULE.—Bring the cwt. into pounds, and calculate as before directed.

EXAMPLES.

43.—3 cwt. 1 qr. 4 lbs. of sugar, at 5d. per pound?

cwt.	qr.	lb.			£.	s.	d.
3	1	4	= 368 pence	=	1	10	8
							5
					£7	13	4 Ans.

44.—5 cwt. 2 qrs. mill board, at 1½d. per pound?

cwt.	qrs.			£.	s.	d.
5	2	=	616			
1½d.	½	÷	77s.	= 3	17	0 Ans.

45.—135 cwt. 1 qr. 27 lbs. of tea, at 5s. per pound?

cwt.	qr.	lbs.		
135	1	27	=	15175
		5¼	÷	
				£3793 15s. Ans.

46.—27 cwt. 2 qrs. 18 lbs. of cast steel, at 3¾d. per lb.?—Ans. £48 8s. 1½d.
47.—27 cwt. 2 qrs. 18 lbs. of shot, at 3d. per lb.?—Ans. £38 14s. 6d.
48.—47 cwt. 2 qrs. 10 lbs. of Wheeler's axe-heads, at 8d. per lb.?—Ans. £177 13s. 4d.
49.—17 cwt. 2 qrs. 11 lbs. of Dutch cheese, at 3¾d. per lb.?—Ans. £30 15s. 11¼d.
50.—31 cwt. 3 qrs. 27 lbs. of Cheshire cheese, at 7¾d. per lb.?—Ans. £115 14s. 0¼d.
51.—73 cwt. 1 qr. 21 lbs. of coffee, at 2s. 1½d. per lb.?—Ans. £873 18s. 1½d.
52.—27 cwt. 1 qr. 7 lbs. of tea, at 4s. 10½d. per lb.?—Ans. £745 12s. 7½d.

PROBLEM 11.

To find the value of any number of cwts., quarters, and pounds, at any price per cwt.

RULE.—Call the cwts. pounds, five times the quarters shillings, and two and the one-seventh times the pounds pence: the result will be the amount at a pound. If the price per cwt. be more, add; if less, subtract proportionably of a pound.

EXAMPLE.

53.—What is 13 cwt. 2 qrs. 14 lbs. of pork worth, at £1. 6s. 8d. per cwt.?

	£	s.	d.	
	13	12	6	per rule, amount at £1. per cwt.
One-third	4	10	10	amount at 6s. 8d.
	£18	3	4	Ans.

54.—What will 27 cwt. 2 qrs. come to, at £2 14s. 6d. per cwt.?—Ans. £74 18s. 9d.

55.—Tell the price of 33 cwt. 1 qr. 14 lbs., at £1 15s. per cwt.?—Ans. £58 8s. 1½d.

56.—If 1 cwt. cost £1 13s. 4d., what will 42 cwt. 1 qr. 20 lbs. come to? Ans. £71 4s. 3½d.

57.—What is 85 cwt. 1 qr. 10 lbs. worth, at £2 17s. 6d. per cwt.?—Ans. £245 5s. 7$\frac{5}{8}$d.

58.—At £4 15s. 6d. the cwt., what is 19 cwt. 3 qrs. 19 lbs. worth?—Ans. £95 2s. 3$\frac{5}{8}$d.

The *Reason* of this rule is established by estimating the cwt. at a pound, and the quarter and pound proportionably.

PROBLEM 12.

To find the value of an ounce, the price per pound being given.

RULE.—If it be an ounce avoirdupois, take the shillings as farthings, and multiply by three; if it be an ounce troy, multiply by four.

Reason.—Because taking the shillings as farthings, is equal to dividing by forty-eight, instead of sixteen; therefore we multiply by three: for $16 \times 3 = 48$; and in the case of troy weight we multiply by four:—$12 \times 4 = 48$.

EXAMPLES.

59.—1 oz. avoirdupois, at 2s. per pound?—Ans. 1½d.
60.—1 oz. avoirdupois, at 1s. per pound?—Ans. 0¾d.
61.—1 oz. avoirdupois, at 3s. per pound?—Ans. 2¼d.
62.—1 oz. avoirdupois, at 6s. per pound?—Ans. 4½d.
63.—1 oz. avoirdupois, at 9s. per pound?—Ans. 6¾d.
64.—1 oz. avoirdupois, at 10s. per pound?—Ans. 7½d.
65.—1 oz. troy, at 2s. per pound?—Ans. 2d.
66.—1 oz. troy, at 1s. per pound?—Ans. 1d.
67.—1 oz. troy, at 3s. per pound?—Ans. 3d.
68.—1 oz. troy, at 6s. per pound?—Ans. 6d.
69.—1 oz. troy, at 9s. per pound?—Ans. 9d.
70.—1 oz. troy, at 10s. per pound?—Ans. 10d.

PROBLEM 13.

To find the value of a ton, the price per pound being given.

RULE.—Find the value of a cwt., and take the shillings in the price of a cwt. as pounds. For every fourpence add six and eightpence.

EXAMPLES.

71.—1 ton, at 1d. per pound?—Ans. £9 6s. 8d.
72.—1 ton, at 3d. per pound?—Ans. £28.
73.—1 ton, at 6d. per pound?—Ans. £56.
74.—1 ton, at 2d. per pound?—Ans. £18 13s. 3d.
75.—1 ton, at 4d. per pound?—Ans. £37 6s. 8d.
76.—1 ton, at 5d. per pound?—Ans. £46 13s. 4d.
77.—1 ton, at 7d. per pound?—Ans. £65 6s. 8d.

78.—1 ton, at 8d. per pound?—Ans. £74 13s. 4d.
79.—1 ton, at 9d. per pound?—Ans. £84.
80.—1 ton, at 10d. per pound?—Ans. £93 6s. 8d.
81.—1 ton, at 11d. per pound?—Ans. £102 13s. 4d.

PROBLEM 14.

The price of one pound in farthings given, to find the value of a ton weight.

RULE.—Multiply the price of one pound in farthings by seven, and divide by three for the answer.

Reason.—7 is $\frac{1}{240}$ and 3 $\frac{1}{560}$ part of a ton; therefore, if you multiply the price of a lb. in farthings by 7, and divide by 3, you have the price of the ton in pounds, shillings, and pence.

EXAMPLES.

82.—If 1 lb. of iron cost 1¾d., what cost 1 ton?

farthings.
7
7
—
3 ÷ 49

Ans. £16 6s. 8d.

83.—If 1 lb. of iron cost 2½d., what cost 1 ton?

farthings.
10
7
—
3 ÷ 70

Ans. £23 6s. 8d.

84.—If 1 lb. of iron cost 2¾d., what is it a ton?—Ans. £25 13s. 4d.
85.—What will a ton come to, if 1 lb. cost 3½d.?—Ans. £32 13s. 4d.
86.—If 1 lb. cost 3¾d., what is a ton worth?—Ans. £35.
87.—If 1 lb. of iron cost 4½d., what is a ton worth?—Ans. £39 13s. 4d.
88.—If 1 lb. cost 4¾d., what is that a ton?—Ans. £42.
89.—If 1 lb. of lead cost 4¾d., what is it per ton?—Ans. £44 6s. 8d.
90.—What is a ton of zinc worth, at 7¾d. per lb.?—Ans. £72 6s. 8d.
91.—1 lb. of sheer steel, at 9¼d., what is a ton worth?—Ans. £86 6s. 8d.

PROBLEM 15.

The price of a ton given, to find the price of a pound.

RULE.—Multiply the price of a ton by three, and divide by seven; you will have the answer in farthings.

EXAMPLES.

92.—If 1 ton of iron cost £16 6s. 8d., what is that a pound?

£.	s.	d.	
16	6	8	
		3	
7 ÷ 49	0	0	
Ans. 7	0	0	farthings = 1¾d.

98.—If 1 ton weight of anything cost £23 6s. 8d., what is it per pound?

£.	s.	d.	
23	6	8	
		3	
7 ÷ 70	0	0	
Ans. 10	0	0	farthings = 2½d.

94.—If a ton of iron cost £39 13s. 4d., what is it per lb.?—Ans. 4¼d.
95.—At £23 13s. 4d. the ton, what is it per lb.?—Ans. 3⅞d.
96.—If 1 ton cost £42, what is that per lb.?—Ans. 4¼d.
97.—At £56 the ton, what is it a lb.?—Ans. 6d.
98.—If a ton cost £84, what is it per lb.?—Ans. 9d.
99.—At £91 the ton, what is that per lb.?—Ans. 9¾d.

PROBLEM 16.

To calculate the value of any number of tons, at pence per stone.

RULE.—Multiply the pence per stone by the tons, and with the product as pence, take parts of 160, being the number of stones in a ton.

EXAMPLES.

100.—12 tons, at 5d. per stone?

12
5

60 = 5s. and 5s. is ¼ 160

Ans. £40

101.—12 tons, at 15d. per stone?

12
15

180 = 15s. and 15s. is ¼ 160
40

Ans. £120

102.—18 tons, at 3⅓d. per stone?

3⅓
18

60 = 5s. and 5s. is ¼ 160

Ans. £40

103.—6 tons, at 5d. per stone?

6
5

30 = 2s. 6d., and 2s. 6d. ⅛ 160

Ans. £20

104.—12 tons, at 16d. per stone?

16
12

192 = 16s. = $\frac{1}{6}$ 160
32

Ans. £128

105.—10 tons, at 4d. per stone?

10

40 = 3s. 4d., and 3s. 4d. $\frac{1}{6} \div 160$

Ans. £26 13s. 4d.

PROBLEM 17.

To calculate the value of any number of tons at pence per cwt.

RULE.—Multiply the pence per cwt. by the tons, and $\frac{1}{120}$ of the product considered as pounds, is the amount.

EXAMPLES.

106.—6 tons, at 2d. per cwt.?

2
6

$\frac{1}{120}$ of 12

£1 Ans.

107.—8 tons, at 3d. per cwt.?

8
3

$\frac{1}{120}$ of 24

£2 Ans.

108.—What will 9 tons come to, at 8d. per cwt.?

8
9

$\frac{1}{120}$ of 72

£6 Ans.

109.—What will 10 tons come to, at 11d. per cwt.?—Ans. £9 3s. 4d.
110.—12 tons, at 7d. per cwt.?—Ans. £7.
111.—24 tons, at 7½d. per cwt.?—Ans. £15.
112.—36 tons, at 13½d. per cwt.?—Ans. £40.
113.—16 tons, at 3¾d. per cwt.?—Ans. £5.
114.—48 tons, at 16¼d. per cwt.?—Ans. £65.
115.—60 tons, at 19½d. per cwt.?—Ans. £97. 10s.

PROBLEM 18.

To calculate for tons, cwts., qrs., and lbs., at any price per ton.

RULE.—Call the tons pounds, the cwts. shillings, a quarter 3d., 14 lbs. 1½d. Multiply or divide as the case requires.

EXAMPLES.

116.—12 tons 12 cwt. 3 qrs., at 6s. 8d. per ton?

	£	s.	d.
$\frac{1}{3} \div$	12	12	9
Ans.	£4	4	3

117.—16 tons 16 cwt. 3 qrs. 14 lbs., at 13s. 4d. per ton?

£.	s.	d.	
16	16	10½	
⅓ ÷ 5	12	3½	
£11	4	7	Ans.

118.—27 tons 18 cwt. 2 qrs. 14 lbs., at 15s. per ton?

£.	s.	d.	
27	18	7½	
¼ ÷ 6	19	7¾	
£20	18	11¼	Ans.

119.—32 tons 12 cwt. 1 qr. 7 lbs., at 16s. per ton?

£.	s.	d.	
32	12	3¾	
⅛ ÷ 6	10	5½	
£26	1	10¼	Ans.

120.—44 tons 14 cwt. 1 qr. 7 lbs., at 16s. 8d. per ton?

£.	s.	d.	
44	14	4¾	
⅛ ÷ 7	9	0¼	
£37	5	3½	Ans.

121.—99 tons 9 cwt. 3 qrs., at 26s. 8d. per ton?

£.	s.	d.	
99	9	9	
⅓ ÷ 33	3	3	
£132	13	0	Ans.

122.—56 tons 8 cwt. 2 qrs., at 22s. 6d. per ton?

£.	s.	d.	
56	8	6	
⅛ ÷ 7	1	0¾	
£63	9	6¾	Ans.

123.—66 tons 6 cwt. 3 qrs.. at 23s. 4d. per ton?

£.	s.	d.	
66	6	9	
⅛ ÷ 11	1	1½	
£77	7	10½	Ans.

124.—126 tons 11 cwt. 3 qrs. 14 lbs., at £12 per ton?

£.	s.	d.	
126	11	10½	
		12	
£1519	2	6	Ans.

CARRIAGE OF RAILWAY GOODS.

125.—What will the carriage of 7 tons, 5 cwt. 3 qrs. 14 lbs. of goods per rail from London to Manchester come to at 25s. 3d. per ton?—Ans. £9 4s. $1\frac{7}{10}$d.

126.—What will the carriage of 9 tons, 9 cwt. 1 qr. 16 lbs. of goods from York to Newcastle, per rail, come to at 17s. 6d. per ton?—Ans. £8 5s. $8\frac{7}{112}$d.

127.—What will the carriage of 37 tons, 13 cwt. 2 qrs. 18 lbs. of goods come to per rail from Bristol to Liverpool, at £1 13s. 10d. per ton?—Ans. £63 14s. $11\frac{7}{16}\frac{5}{0}$d.

128.—What will the carriage of 43 tons, 1 cwt. 1 qr. 1 lb. of goods per rail come to from Paddington to Edinburgh, at £2 7s. 9d. the ton?—Ans. £42 16s. $3\frac{1}{2}\frac{6}{2}\frac{3}{4}\frac{}{0}$d.

129.—What will the carriage of 84 tons, 3 cwt. 3 qrs. 20 lbs. of goods per rail from Manchester to Aberdeen come to at 52s. 9d. the ton?—Ans. £222 1s. $4\frac{1}{5}\frac{2}{8}$d.

130.—Admit that 45 tons, 3 cwt. 3 qrs. 17 lbs. of goods were booked at Manchester for Edinburgh, at the rate of 1½d. per ton per mile, and the distance 272 miles: the Lancashire Company carries the goods 80 miles; York and Newcastle Company 76 miles; Newcastle and Berwick, 64 miles; Berwick and Edinburgh 52 miles: what is the respective share of the amount due to each company?

EXPLANATION.

45 tons, 3 cwt. 3 qrs. 17 lbs., at 1½d. per ton per mile, is 4s. 8½d. (nearly) per mile.

Lancashire Company.....	80 miles, at	4s. 8½d.	=	£18	12s.	8d.
York and Newcastle do	76	do.	at	do.	=	17	17	10
Newcastle and Berwick do..	64	do.	at	do.	=	15	1	4
Berwick and Edinburgh do.	52	do.	at	do.	=	12	4	10

NOTE.—The above will be sufficient to show the railway clerk or manager how to calculate any quantity of goods, at any price per ton per mile, and will be found useful in railway offices, either for goods or passengers, for any distance, no matter how many companies may be concerned.

EXERCISE VII.

RULE FOR SPIRIT MERCHANTS.

PROBLEM 1.

Having the price per gallon, to know the amount per tun.

RULE.—Write the pence which the gallon costs as pounds, to which add its one-twentieth; the sum will be the cost per tun.

EXAMPLE.

1.—At 6s. 7½d. per gallon, what is that per tun?

	£.	s.	d.
	79	10	0
One-twentieth,	3	19	6
Ans.	£83	9	6

PROBLEM 2.

Having the price per tun, to find the cost per gallon.

RULE.—Divide the cost per tun by 21, subtract the quotient from the price, and the remainder is so many pence per gallon.

EXAMPLE.

2.—At £84 10s. 6d. per tun, what is that per gallon?

	£.	s.	d.
21 ÷ 84	10	6	
	4	0	6

Ans. £80 10 0=80d., or 6s. 8½d.

3.—If a tun of spirits cost £78 15s., what will 1 gal. cost?—Ans. 6s. 3d.

PROBLEM 3.

Having the price per gallon, to know the amount per hogshead.

RULE.—Take the one-fifteenth of the farthings as pounds, from which deduct the cost of one gallon for the price per hogshead.

EXAMPLE.

4.—At 5s. 7¼d. per gallon, what is that per hogshead?

5 7¼ = 271 farthings.

	£.	s.	d.
One-fifteenth ÷ 271 =	18	1	4
		5	7¼

Ans. £17 15 8¼

PROBLEM 4.

By knowing the price per glass, to know the cost per hogshead.

RULE.—Multiply four pounds four shillings by the price per glass in farthings for the cost per hogshead, and you have the answer in pounds and shillings.

EXAMPLE.

5.—At 1½d. per glass, what is that per hogshead?

	£.	s.
	4	4
		6
Ans.	£25	4

PROBLEM 5.

By knowing the amount per hogshead, to find the price per glass.

RULE.—From the price of the hogshead in pounds, deduct its one-twenty-first part; the pounds that will remain will be one-fourth farthings per glass; and for every five shillings (if any), count the one sixteenth of a farthing.

EXAMPLE.

6.—At £25 4s. per hogshead, what is that per glass?

£	s.
25	4
24	1 4

Ans. 4 ÷ £24 0 = 6 farthings or 1½d. per glass.

EXERCISE VIII.

NEW METHOD OF TROY WEIGHT.

PROBLEM 1.

Knowing the price per grain, to find the cost per ounce.

RULE.—The cost per grain in halfpence will be the price per ounce in pounds; and, *vice versa*, the cost per ounce in pounds will be the value of the grain in halfpence.

EXAMPLE.

At four halfpence per grain, it will be £4 per ounce; and at £4 per ounce, it will be four halfpence per grain.

PROBLEM 2.

Knowing the price per pennyweight, to find the amount of any number of pounds.

RULE.—Multiply the pounds weight by the price per pennyweight and you have the answer in pounds sterling.

EXPLANATION.

At 4d. per pennyweight, 80 lbs. will cost £320.—Ans. × 80 by 4 = £320.

PROBLEM 3.

Knowing the price of an ounce troy, to find the value of any number of pounds, ounces, pennyweights, and grains.

RULE.—Reduce the pounds to ounces, which increase by the given ounces, then call the sum pounds, the pennyweights shillings, and half the grains pence, of which take such parts of the same as the price per ounce is of a pound.

EXAMPLE.

1.—At 5s. 6d. per ounce, what is the value of 10 lbs. 6 dwts. and 14 grains?

10 lbs. = 120 oz. at 5s. 6d. is 33 0 0
6 dwts. and 14 grs. = 1· $9\frac{17}{20}$

Ans. £33 1 $9\frac{17}{20}$

PROBLEM 4.

Having the price of an ounce troy, to know the value of any number of pounds.

RULE.—Multiply the pence per ounce by the number of lbs.; the product will be the answer in shillings.

EXAMPLE.

2.—At $4\frac{1}{2}$d. per ounce, what is the value of 7 lbs.?

$4\frac{1}{2}$d.
7

Ans. 31 6, or £1 11s. 6d.

PROBLEM 5.

By having the price of a dwt. in farthings, to find what one pound costs.

RULE.—Take $\frac{1}{4}$ of the price of a dwt. in farthings; the quotient will be the answer in pounds.

EXAMPLES.

3.—If 1 dwt. of silver costs $3\frac{1}{4}$d., what will 1 lb. cost?

4 ÷ 13

Ans. £3 5 0

4.—If 1 dwt. of silver costs 5d., what will 1 lb. cost?—Ans. £5.

5.—If 1 dwt. of silver costs $4\frac{3}{4}$d., what will 1 lb. cost?

4 ÷ 19

Ans. £4 15 0

PROBLEM 6.

If the quantity be any number of pounds.

RULE.—Multiply the price of a dwt. in farthings, and the given number of pounds together; divide that product by 4 for the answer.

EXAMPLES.

6.—If 1 dwt. of silver costs 4½d., what will 24 lbs. cost?

24
19

4 ÷ 456

Ans. £114

7.—If 1 dwt. costs 6½d., what will 36 lbs. come to?—Ans. £225.
8.—If 1 dwt. costs 7½d., what will 48 lbs. cost?—Ans. £360.

EXERCISE IX.

TO CALCULATE THE VALUE OF A THOUSAND.

PROBLEM 1.

By having the price of one, to know the value of a thousand.

RULE.—Call the pence pounds, which multiply by four and the one-sixth for the answer.

Reason.—To multiply by four and one-sixth is evident; as four and one-sixth times 240 is 1000. Hence four and one-sixth will apply generally where the price of 1000 is required, the rate for one being given.

EXAMPLES.

1.—At 1¼d. per yard, what will 1000 yards cost?

£.	s.	d.
1	15	0
		4⅙
7	0	0
	5	10

Ans. £7 5 10

2.—1000 yards of broad cloth, at 7s. 9d. per yard?—Ans. £387 10s.
3.—1000 yards of linen, at 2s. 7½d. per yard?—Ans. £131 5s.
4.—1000 gallons of Cogniac, at 14s. 7d. per gallon?—Ans. £729 3s. 4d.
5.—1000 barrels of herrings, at 19s. 9½d. per barrel?—Ans. £990 12s. 6d.
6.—1000 loads of oatmeal, at £1 13s. 9d. per load?—Ans. £1687 10s.
7.—1000 planks of larchwood, at 11s. 10½d. per plank?—Ans. £593 15s.
8.—1000 gallons of oil, at 16s. 5d. per gallon?—Ans. £820 16s. 8d.
9.—1000 yards of green baize, at 7s. 9d. per yard?—Ans. £387 10s.
10.—1000 pounds of silver, at £3 5s. per pound?—Ans. £3250.
11.—1000 perches of mason work, at 3s. 9d. per perch?—Ans. £187 10s.
12.—1000 acres of land, at 15s. 9d., what is that yearly?—Ans. £787 10s.
13.—The grazing of 1000 head of cattle, at 19s. 8d. a piece, what does it come to?—Ans. £983 6s. 8d.

PROBLEM 2.

To reverse the above, when the price of the thousand is an integral number of pounds.

RULE.—From the price in pounds take four times said pounds, keeping the product two figures to the right of the digit's place; the remainder will be the farthings per integer, saving the two last digits, which will be centescimal parts of a farthing.

EXAMPLE.

14.—Suppose 1000 yards cost £25, what is that per yard?

£25
100

Ans. 24,00 farthings, or 6d. per yard.

PROBLEM 3.

By having the price of 100, *to know the value of* 1000.

RULE.—Half the number of shillings will count pounds; and add a cypher to the number of pence, you have the pence.

EXAMPLES.

15.—1000 bricks, at 8s. 4d. per hundred?

	£.	s.	d.
Per rule, the half of 8 is =	4	0	0
Add 0 to the pence is 40 =	0	3	4
Ans.	£4	3	4

16.—1000 paving tiles, at 4s. 7d. per hundred?—Ans. £2 5s. 10d.
17.—1000 needles, at 2s. 4d. per hundred?—Ans. £1 3s. 4d.
18.—2000* bricks, at 5s. 8d. per hundred?—Ans. £5 13s. 4d.
19.—1000 bodkins, at 4d. the hundred?—Ans. 3s. 4d.
20.—3000 knife-handles, at 1s. 5d. per hundred?—Ans. £2 2s. 6d.
21.—2000 oranges, at 12s. 3d. per hundred?—Ans. £12 5s.
22.—1000 plants, at 5s. 1d. per hundred?—Ans. £2 10s. 10d.
23.—1000 eightpenny nails, at 4d. per hundred?—Ans. 3s. 4d.
24.—1000 iron hooks, at 8½d. per hundred?—Ans. 6s. 10½d.
25.—2000 iron piercers, at 6d. per hundred?—Ans. 10s.
26.—1000 yards of twine, at 2s. 8d. per hundred yds.?—Ans. £1 6s. 8d.
27.—1000 lbs. of linen thread, at 7s. 6d. per hundred lbs.?—Ans. £3 15s.
28.—1000 lbs. of cheese, at £2 10s. 6d. per hundred lbs.?—Ans. £25 5s.
29.—1000 lbs. of tea, at £25 6s. 9d. per hundred lbs.?—Ans. £253 7s. 6d.
30.—1000 pantiles, at 3s. 6d. per hundred?—Ans. £1 15s.
31.—1000 slates, at 7s. 6d. per hundred?—Ans. £3 15s.
32.—1000 nails, at 10d. the hundred?—Ans. 8s. 4d.

* When there are 2000, call the shillings pounds, and double the pence before you add the 0. If 3000, add half as many more to the shillings, and treble the pence, and so on if the numbers be higher.

33.—1000 books, at 4s. 1d. per hundred?—Ans. £2 0s. 10d.
34.—1000 flower pots, at 6½d. per hundred?—Ans. 5s. 5d.
35.—1000 stone jars, at 1s. 2½d. per hundred?—Ans. 11s. 10½d.
36.—1000 iron bolts, at 2s. 1½d. per hundred?—Ans. £1 1s. 5½d.
37.—2000 stone jugs, at 4s. 2¾d. per hundred?—Ans. £4 4s. 7d.
38.—3000 brass nails, at 9d. per hundred?—Ans. £1 2s. 6d.
39.—1000 yards of inkle, at 1s. 2½d. per hundred?—Ans. 12s. 1d.
40.—1000 brass rings, at 9¼d. per hundred?—Ans. 7s. 8½d.
41.—1000 yards of silk, at £34 17s. 6d. the 100 yards?—Ans. £348 15s.
42.—1000 yds. of cambric, at £45 15s. 10d. the 100 yds.?—Ans. £457 18s. 4d.
43.—1000 tons of coal, at £97 18s. 4d. the 100 tons?—Ans. £979 3s. 4d.
44.—1000 loads of flour, at £157 17s. 6d. the 100 loads?—Ans. £1578 15s.

EXERCISE X.

SALARIES AND DAILY WAGES.

TABLE OF SALARIES, ETC., FROM £1 TO £150 PER ANNUM, REDUCED TO SO MUCH PER MONTH, PER WEEK, PER DIEM.

Y.	Pr. M.	Pr. W.	Pr. D.	Y.	Pr. M.	Pr. W.	Pr. D.	Y.	Pr. M.	Pr. W.	Pr. D.
£.	s. d.	s. d.	s. d.	£.	£. s. d.	s. d.	s. d.	£.	£. s. d.	£. s. d.	s. d.
1	1 8	0 4¾	0 0⅔	11	0 18 4	4 2⅔	0 7⅔	30	2 10 0	0 11 6	1 7¾
2	3 4	0 9½	0 1⅓	12	1 0 0	4 7½	0 8	40	3 6 8	0 15 4	2 2½
3	5 0	1 1¼	0 2	13	1 1 8	4 11⅔	0 8⅔	50	4 3 4	0 19 2½	2 9
4	6 8	1 6⅔	0 2⅔	14	1 3 4	5 4½	0 9¼	60	5 0 0	1 3 0¾	3 3⅓
5	8 4	1 11	0 3⅓	15	1 5 0	5 9	0 10	70	5 16 8	1 6 10¾	3 10
6	10 0	2 3½	0 4	16	1 6 8	6 1⅔	0 10¾	80	6 13 4	1 10 8¾	4 4⅓
7	11 8	2 8¼	0 4⅔	17	1 8 4	6 6⅔	0 11⅔	90	7 10 0	1 14 6¾	4 11⅔
8	13 4	3 0⅔	0 5¼	18	1 10 0	6 10⅔	0 11⅔	100	8 6 8	1 18 4¾	5 5⅔
9	15 0	3 5¼	0 6	19	1 11 8	7 3½	1 0½	125	10 8 4	2 7 11⅓	6 10½
10	16 8	3 10	0 6½	20	1 13 4	7 8	1 1¼	150	12 10 0	2 17 6½	8 2¾

PROBLEM 1.

Knowing the daily wages, to find the yearly salary.

RULE.—Call the pence pounds, to which add half thereof, and five days' wages: collect these items into one total for the answer.

Otherwise.—For every penny per day, it will be one pound, one half-pound, one groat, and one penny per year.

EXAMPLE.

1.—At 15¾d. per day, what is the amount per annum?

£.	s.	d.	
15	15	0	the amount of 240.
7	17	6	the amount of 120.
0	6	6¾	the wages of 5 days.
Ans. £23	19	0¾	yearly salary.

PROBLEM 2.

Having the yearly salary, to know the daily wages.

RULE.—Double the annual salary in pounds, the one-third thereof will be the price per day. Observe—when the shillings are ten or more, to double the pounds, add one; but if less than ten, they are not to be taken into account. You are further to observe—if after the division of three, one should remain, allow it a halfpenny; but if two remain, allow three farthings.

EXAMPLE.

2.—A servant's wages are £23 19s. 0¾d. yearly; what is that per day?

£23
2

3 ÷ 47

Ans. 15¾d. per day.

PROBLEM 3.

To find what any number of pence per day will amount to in a year.

RULE.—Add together as many pounds, half-pounds, fourpences, and pence, as there are pence per day. Thus, threepence per day is three pounds, three half-pounds, three fourpences, and threepence in a year; that is four pounds, eleven shillings, and threepence.

Reason.—Because, £1 = 240d., 10s. = 120d., 4d. and 1d. = 5d. 240 + 120 + 4 + 1 = 365.

Take three hundred and sixty-five as pence; that is one pound, ten shillings, and five pence: multiply this by the number of pence per day.

3.—365 days, at 2d. per day?—Ans. £3 0s. 10d.
4.—365 days, at 4d. per day?—Ans. £6 1s. 8d.
5.—365 days, at 5d. per day?—Ans. £7 12s. 1d.
6.—365 days, at 6d. per day?—Ans. £9 2s. 6d.
7.—365 days, at 7d. per day?—Ans. £10 12s. 11d.
8.—365 days, at 8d. per day?—Ans. £12 3s. 4d.
9.—365 days, at 9d. per day?—Ans. £13 13s. 9d.
10.—365 days, at 10d. per day?—Ans. £15 4s. 2d.
11.—365 days, at 16d. per day?—Ans. £24 6s. 8d.
12.—365 days, at 18d. per day?—Ans. £27 7s. 6d.
13.—½ year, at 14d. per day?—Ans. £10 12s. 11d.
14.—¼ year, at 20d. per day?—Ans. £7 12s. 1d.

PROBLEM 4.

What any number of pence per day will amount to in 313 *days, the number of week-days in a year, omitting Sundays, Christmas, and Good Friday.*

RULE.—Multiply £1 6s. 1d. by the pence per day, and you have the yearly salary for 313, which is the number of working days in a year.

Reason.—Because 313 pence equal £1 6s. 1d., as stated.

15.—313 days, at 2d. per day?—Ans. £2 12s. 2d.
16.—313 days, at 5d. per day?—Ans. £6 10s. 5d.
17.—313 days, at 6d. per day?—Ans. £7 16s. 6d.
18.—313 days, at 7d. per day?—Ans. £9 2s. 7d.
19.—313 days, at 13d. per day?—Ans. £16 19s. 1d.
20.—313 days, at 14d. per day?—Ans. £18 5s. 2d.

PROBLEM 5.

NOTE.—Should there be farthings in the rate per day, add 7s. 7¼d. for every farthing, for 365 days; and 6s. 6¼d. for 313 days.

Reason.—Because, 7s. 7¼d. = 365 farthings, 6s. 6¼d. = 313 farthings.

21.—365 days, at 2¼d. per day?—Ans. £3 8s. 5¼d.
22.—365 days, at 3¼d. per day?—Ans. £4 18s. 10¼d.
23.—365 days, at 6¼d. per day?—Ans. £9 17s. 8¼d.
24.—313 days, at 2¼d. per day?—Ans. £2 18s. 8¼d.
25.—313 days, at 3¼d. per day?—Ans. £4 4s. 9¼d.
26.—313 days, at 6¼d. per day?—Ans. £8 9s. 6¼d.

PROBLEM 6.

To find what any number of shillings per week will amount to in a year.

RULE.—Add together two and a half times as many pounds, and twice as many shillings, as there are shillings per week.

EXPLANATION.

Thus,—6s. per week is £15 12s.; for twice as many pounds is £12; and half as many pounds is £3.; and twice as many shillings is 12s.: and £12 + £3 + 12s. = £15 12s.

Reason.—Because, 52, the number of weeks in a year, is equal to 20 + 20 + 12 = 52.

27.—1 year, at 4s. per week?—Ans. £10 8s.
28.—1 year, at 5s. per week?—Ans. £13.
29.—1 year, at 6s. per week?—Ans. £15 12s.
30.—1 year, at 7s. per week?—Ans. £18 4s.
31.—1 year, at 8s. per week?—Ans. £20 16s.
32.—1 year, at 9s. per week?—Ans. £23 8s.
33.—1 year, at 10s. per week?—Ans. £26.
34.—1 year, at 11s. per week?—Ans. £28 12s.
35.—1 year, at 12s. per week?—Ans. £31 4s.
36.—1 year, at 16s. per week?—Ans. £41 12s.

PROBLEM 7.

To find what any number of pence per week will amount to in a year.

RULE.—Take four times as many shillings, and four times as many pence, as there are pence per week: if there be farthings in the rate, add one shilling and a penny, for every farthing.

Reason.—Because, 52d. = 4s. 4d., and 52 farthings = 13d., or 1s. 1d.

37.—1 year, at 2d. per week?—Ans. 8s. 8d.
38.—1 year, at 3d. per week?—Ans. 13s.
39.—1 year, at 4d. per week?—Ans. 17s. 4d.
40.—1 year, at 7d. per week?—Ans. 30s. 4d.
41.—1 year, at 9d. per week?—Ans. 39s.
42.—1 year, at 11d. per week?—Ans. 47s. 8d.
43.—1 year, at 2¼d. per week?—Ans. 9s. 9d.
44.—1 year, at 3¼d. per week?—Ans. 15s. 2d.
45.—1 year, at 4¼d. per week?—Ans. 18s. 5d.
46.—1 year, at 7¾d. per week?—Ans. 33s. 7d.
47.—1 year, at 9½d. per week?—Ans. 41s. 2d.
48.—1 year, at 11¾d. per week?—Ans. 50s. 11d.

EXERCISE XI.

NEW METHOD OF EXTRACTING THE SQUARE ROOT.

PROBLEM 1.

A new and expeditious method for extracting the square root, never before discovered: it has many advantages. It can be learned with the greatest facility, and after the same manner, any may root be extracted, such as the cube, biquadrate, sursolid, &c., &c.

RULE.—Divide the given number whose root is to be extracted, by some digit involved to the same power; divide the quotient by the latter divisor, or by a like power of some other digit; continue the division till one or some small insignificant remainder occurs, and choose, if possible, such divisors as the dividend will contain without a remainder. Then the required root, taken off the different divisors will be always rational, and these multiplied into each other, will be the true root, if there be no remainder; but if a remainder occurs, place the root thus found drawn into the index of the power beneath the excess of the given number, whose root is to be extracted, above the product of the respective divisors, which increment must be affixed to the rational root for the root of the required number, which will be found sufficiently correct for any practical purpose. Hence the operator will at once see the necessary change that will make the operation conclusive.

EXAMPLE.

1.—What is the square root of 144?

First, divide 144 by 16, and divide the quotient by 9; then, 16 and 9 are the divisors, whose root are 4 and 3: the product of these will be 12, which is the root required.

Next, if the number be irrational, as seven hundred and twenty, and its root be required, divide by nine, then by sixteen, and next by four; then

nine, sixteen, and four, are the divisors, and one hundred and forty-four the remainder. Hence the root of the rational part of seven hundred and twenty-four, and its double placed beneath one hundred and forty-four. This fraction affixed to twenty-four, gives twenty-seven for the root, nearly.

2.—What is the square root of 3969?—Ans. 63.
3.—Required the square root of 729?—Ans. 27.
4.—What is the square root of 43264?—Ans. 208.
5.—What is the square root of 50865424?—Ans. 7132.
6.—What is the square root of ·00032754?—Ans. ·01809+.
7.—What is the square root of 2·2710957?—Ans. 1·50701+.

PROOF.—Square the root found, and to the product add the remainder, if any. If the work be right, the sum will be the same as the number to be extracted.

Squares:—1, 4, 9, 16, 25, 36, 49, 64, 81.
Roots:—1, 2, 3, 4, 5, 6, 7, 8, 9.

CUBE ROOT.

RULE.—Point out the number given in periods of three figures each; find the nearest cube to the first period, then subtract, and put the root in the quotion: three times the square of the root will be the true divisor, for the next. Multiply the figures found by three; join the product to the next root; multiply this number by the new root figure; place that product two figures to the right, under the trial divisor, to which add the same, and you have the true divisor.

PROOF.—Cube the root, and to the product add the remainder, and the sum will be the same as the number to be extracted.

Cubes:—1, 8, 27, 64, 125, 216, 343, 512, 729.
Roots:—1, 2, 3, 4, 5, 6, 7, 8, 9.

EXAMPLE.

8.—What is the cube root of 373248?

373248 (27
343

$7^2 = 49 \times 3 = 147 \div 302,48$

30248

Proof.
72
72
5184
72
373248 cube.

7^2 or $49 \times 300 \times 2 = 29400$
$7 \times 30 \times 2^2$ or $4 = 840$
2^3 or $2 \times 2 \times 2 = 8$

9.—What is the cube root of 48625125?—Ans. 365.
10.—What is the cube root of 84604519?—Ans. 439.
11.—What is the cube root of 259694072?—Ans. 638.

EXERCISE XII.

CALCULATION OF INTEREST.

PROBLEM 1.

To calculate interest on any principal for ninety-one, sixty-one, or thirty-one days, at five per cent. per annum.

RULE.—91 days will be 3d. per pound.
61 " 2d. "
31 " 1d. " nearly.

EXAMPLES.

1.—What is the interest on £137 for 91 days, at 5 per cent.?

3d. $\frac{1}{4} \div 137$

$2{,}0 \div 3{,}4$—3

Ans. £1 14 3

2.—What is the interest on £233 for 61 days, at 5 per cent.?

$2\frac{1}{3}$ 233

$2{,}0 \div 3{,}8$—10

Ans. £1 18 10 nearly.

3.—What is the interest on £1000 for 31 days, at 5 per cent.?

$12 \div 1000$

$2{,}0 \div 8{,}3$ 4

Ans. £4 3 4 nearly.

PROBLEM 2.

To calculate interest upon any sum, at five per cent. per annum.

RULE.—Reckon a shilling for every pound, and threepence for every five shillings.

EXAMPLES.

4.—Interest on £12, at 5 per cent.?—Ans. 12s.
5.—Interest on £42, at 5 per cent.?—Ans. £2 2s.
6.—Interest on £68, at 5 per cent.?—Ans. £3 8s.
7.—Interest on £75, at 5 per cent.?—Ans. £5 15s.
8.—Interest on £110, at 5 per cent.?—Ans. £5 10s.
9.—Interest on £98, at 5 per cent.?—Ans. £4 18s.
10.—Interest on £26 5s., at 5 per cent.?—Ans. £1 6s. 3d.
11.—Interest on £47 10s., at 5 per cent.?—Ans. £2 7s. 6d.
12.—Interest on £69 15s., at 5 per cent.?—Ans. £3 9s. 9d.

13.—Interest on £87 5s., at 5 per cent. ?—Ans. £4 7s. 3d.
14.—Interest on £99 15s., at 5 per cent. ?—Ans. £4 19s. 9d.
15.—Interest on £108 10s., at 5 per cent. ?—Ans. £5 8s. 6d.

PROBLEM 3.

To calculate interest at five per cent. for months.

RULE.—Take the pounds as pence, and multiply these pence by the number of months, for the answer in pence.

EXAMPLES.

16.—Interest on £4 for two months, at 5 per cent. ?—Ans. 8d.
17.—Interest on £7 for three months, at 5 per cent. ?—Ans. 1s. 9d.
18.—Interest on £9 10s. for three months, at 5 per cent. ?—Ans. 2s. 4½d.
19.—Interest on £72 for nine months, at 5 per cent. ?—Ans. £2 14s.
20.—Interest on £96 5s. for three months, at 5 per cent.?—Ans. £1 4s. 0¾d.
21.—Interest on £144 15s. for nine months, at 5 per cent. ?—Ans. £5 8s. 6¾d.

PROBLEM 4.

To calculate interest at five per cent. for days.

RULE.—Multiply either the money or the days by one-third of the money or the days; reject the units' figure, and you have the answer in pence. Thus, the interest of £27 for 18 days: $27 \times 6 = 16$ (2=16d.; or $18 \times 9 = 16$) 2=16d. interest.

EXAMPLES.

22.—Interest on £21 for 6 days, at 5 per cent.?—Ans. 4d.
23.—Interest on £24 for 7 days, at 5 per cent.?—Ans 5½d.
24.—Interest on £33 for 9 days, at 5 per cent.?—Ans. 9¾d.
25.—Interest on £41 for 12 days, at 5 per cent.?—Ans. 1s. 4½d.
26.—Interest on £76 for 6 days, at 5 per cent.?—Ans. 1s. 3d.
27.—Interest on £85 for 15 days, at 5 per cent.?—Ans. 3s. 6½d.
28.—Interest on £159 for 27 days, at 5 per cent.?—Ans. 11s. 11d.

PROBLEM 5.

To calculate interest at six per cent. for months.

RULE.—Multiply the pounds and months; cut off the unit figure of the product, and the remainder will be the interest in shillings. The figure cut off is tenths of a shilling. Thus, the interest of £9 at 6 per cent., for 5 months, is $9 \times 5 = 4$ ($5 = 4\frac{5}{10}$ s. = 4s. 6d.

EXAMPLES.

29.—Interest on £7 for three months, at 6 per cent. ?—Ans. 2s. 1d.
30.—Interest on £12 for four months, at 6 per cent. ?—Ans. 4s. 9d.
31.—Interest on £270 for seven months, at 6 per cent. ?—Ans. £9 9s.
32.—Interest on £350 for eight months, at 6 per cent. ?—Ans. £14.
33.—Interest on £90 for eight months, at 6 per cent. ?—Ans. £3 12s.
34.—Interest on £380 for nine months, at 6 per cent. ?—Ans. £17 2s.

PROBLEM 6.

To find the interest of any sum, for months, at three per cent.

RULE.—Multiply $\frac{1}{20}$ of the principal by the months, and you have the answer in shillings; or, multiply $\frac{1}{10}$ of the principal by $\frac{1}{2}$ the months, and you have the same.

EXAMPLES.

35.—What is the interest on £220 for 11 months at 3 per cent.?

$\frac{1}{20}$ 220	*Otherwise*	$\frac{1}{10}$ 220
11		22
11		57
2,0÷12,1		110
Ans. £6 1s.		11
		2,0 12,1
		Ans. £6 1s.

36.—What is the interest on £200 for 10 months, at 3 per cent.?—Ans. £5.
37.—What is the interest on £180 for 9 months, at 3 per cent.?—Ans. £4 1s.
38.—What is the interest on £160 for 8 months, at 3 per cent.?—Ans. £3 4s.
39.—What is the interest on £140 for 7 months, at 3 per cent.?—Ans. £2 9s.
40.—What is the interest on £245 13s. 8d. for 1 month, at 3 per cent.?—Ans. £12 5s. 8d.

NOTE.—The above will be found very useful in Savings' Banks.

PROBLEM 7.

To calculate interest for years at any rate per cent.

RULE.—Multiply the time by the rate per cent.; consider what part or parts the product is of 100; take such part or parts of the principal, and you have the interest.

EXAMPLES.

41.—Find the interest on £125 1s. 8d. for one year, at 5 per cent.?

	£	s.	d.
$\frac{1}{20}$ ÷	125	1	8
Ans.	£6	5	1

42.—What is the interest on £7373 19s. 0d. for 1 year at 5 per cent.?

	£	s.	d.
$\frac{1}{20}$ ÷	7373	19	0
Ans.	£368	13	$11\frac{1}{2}$

PROBLEM 8.

Find the interest of any sum at any rate per cent. per annum.

RULE.—Multiply time and rate, and divide the result into the principal, and you have the interest.

EXAMPLES.

43.—What is the interest of £991 3s. 3d. for 3⅓ years, at 3 per cent. per annum?

	£.	s.	d.
3⅓			
3			
10 ÷	991	3	3
Ans.	£99	2	$3\frac{9}{10}$

44.—What is the interest on £765 12s. 7d. for 4 years, at 2½ per cent. per annum?

	£	s.	d.
2½			
4			
10 ÷	765	12	7
Ans.	£76	11	$3\frac{1}{10}$

45.—What is the interest on £78 12s. 10d. for 12½ years, at 1 per cent. per annum?

	£	s.	d.
⅛ ÷	78	12	10
Ans.	£9	16	7½

46.—Find the interest on £888 8s. 8d. for 3¾ years, at 3¾ per cent. per annum?—Ans. £124 18s. $8\frac{5}{8}$d.

47.—What is the interest of £325 7s. 6d. for 3½ years, at 6 per cent. per annum?—Ans. £68 6s. 6½d.

48.—Tell the interest on £257 5s. 1d. for 1¼ years, at 4 per cent.—Ans. £18 0s. 1¼d.

49.—At 5 per cent. what will the interest be on £479 5s. for 5 years?—Ans. 125 16s. 0¾d.

50.—What will the interest on £175 17s. be for 2¾ years, at 4½ per cent. per annum?—Ans. £21 15s. 2¼d.

51—At 5¼ per cent. per annum, what will the interest on £279 13s. 8d. amount to?—Ans. £51 7s. 10d.

Interest for days, at any rate per cent.

GENERAL RULE.—Multiply the sum by the number of days, and that product by double the rate per cent.; divide by 73000, and the quotient will be the interest in pounds.

EXERCISE XIII.

TABLE OF COMMERCIAL DISCOUNT,

SHOWING THE ALLOWANCE AT THE RATE PER CENT. OPPOSITE TO IT ON A POUND AND A SHILLING.

Per cent.		In the £.			In the Shilling.	Per cent.		In the £.			In the Shilling.
$\frac{1}{8}$	is	0s.	$0\frac{3}{10}$d.		$\frac{3}{240}$d.	$27\frac{1}{8}$	is	5s.	6d.		$3\frac{3}{10}$d.
$\frac{1}{4}$	...	0	$0\frac{6}{10}$	...	$\frac{6}{240}$	$28\frac{3}{4}$	...	5	9	...	$3\frac{9}{240}$
$\frac{1}{2}$	...	0	$1\frac{1}{2}$	...	$\frac{3}{60}$	30	...	6	0	...	$3\frac{3}{4}$
$\frac{3}{4}$	...	0	$1\frac{4}{5}$	...	$\frac{9}{240}$	$31\frac{1}{4}$	...	6	3	...	$3\frac{3}{4}$
1	...	0	$2\frac{2}{5}$	...	$\frac{6}{60}$	$32\frac{1}{2}$	...	6	6	...	$3\frac{13}{240}$
$1\frac{1}{4}$	...	0	3	...	$\frac{3}{240}$	$33\frac{3}{4}$	...	6	9	...	$4\frac{1}{240}$
$2\frac{1}{2}$	...	0	6	...	$\frac{3}{120}$	35	...	7	0	...	$4\frac{1}{6}$
$3\frac{3}{4}$	...	0	9	...	$\frac{9}{240}$	$36\frac{1}{4}$	...	7	3	...	$4\frac{7}{240}$
5	...	1	0	...	$\frac{3}{60}$	$37\frac{1}{2}$	...	7	6	...	$4\frac{1}{2}$
$6\frac{1}{4}$	...	1	3	...	$\frac{3}{48}$	$38\frac{3}{4}$	...	7	9	...	$4\frac{13}{240}$
$7\frac{1}{2}$	...	1	6	...	$\frac{9}{120}$	40	...	8	0	...	$4\frac{4}{5}$
$8\frac{3}{4}$	...	1	9	...	$1\frac{1}{240}$	$41\frac{1}{4}$	...	8	3	...	$4\frac{19}{240}$
10	...	2	0	...	$1\frac{1}{20}$	$42\frac{1}{2}$	...	8	6	...	$5\frac{1}{120}$
$11\frac{1}{4}$	...	2	3	...	$1\frac{7}{240}$	$43\frac{3}{4}$	...	8	9	...	$5\frac{1}{4}$
$12\frac{1}{2}$	...	2	6	...	$1\frac{1}{20}$	45	...	9	0	...	$5\frac{2}{5}$
$13\frac{3}{4}$	...	2	9	...	$1\frac{13}{240}$	$46\frac{1}{4}$	...	9	3	...	$5\frac{11}{120}$
15	...	3	0	...	$1\frac{1}{8}$	$47\frac{1}{2}$	...	9	6	...	$5\frac{17}{120}$
$16\frac{1}{4}$	...	3	3	...	$1\frac{19}{240}$	$48\frac{3}{4}$	...	9	9	...	$5\frac{17}{120}$
$17\frac{1}{2}$	...	3	6	...	$2\frac{1}{120}$	50	...	10	0	...	6
$18\frac{3}{4}$	...	3	9	...	$2\frac{1}{48}$	55	...	11	0	...	$6\frac{3}{5}$
20	...	4	0	...	$2\frac{2}{5}$	60	...	12	0	...	$7\frac{1}{5}$
$21\frac{1}{4}$	...	4	3	...	$2\frac{11}{120}$	65	...	13	0	...	$7\frac{4}{5}$
$22\frac{1}{2}$	...	4	6	...	$2\frac{17}{120}$	70	...	14	0	...	$8\frac{2}{5}$
$23\frac{3}{4}$	...	4	9	...	$2\frac{17}{120}$	75	...	15	0	...	9
25	...	5	0	...	3	80	...	16	6	...	$9\frac{3}{5}$
$26\frac{1}{4}$	...	5	3	...	$3\frac{3}{240}$						

NOTE.—The above calculation in the shillings is the nearest to which a mercantile man can lay claim.

By having the discount on a pound or a shilling (which the table shows) you may easily find on any sum.

EXPLANATION.

What is the discount on £7, at 18¾ per cent.?
Opposite 18¾ per cent. is 3s. 9d. the discount on a £1.

£7

Ans. £1 6 3

Find the discount on 11s. at 37½ per cent.?
Opposite 37½ per cent. on a shilling is 4½d.

11

Ans. 4s. 1½d.

PROBLEM 1.

When the discount is an aliquot part of £100.

RULE.—Take the parts of the principal with the given rate per cent. and you have the discount. Subtract the discount from the principal, and you have the net money.

EXAMPLES.

1.—What is the discount on £666 6s. 6½d. at 50 per cent.?

	£	s.	d.
½ ÷	666	6	6½
Ans.	£333	3	3½ dis.

2.—Find the discount on £999 9s. 9d. at 33⅓ per cent.

	£	s.	d.
⅓ ÷	999	9	9
Ans.	£333	3	3 dis.

3.—Tell the discount on £762 16s. at 7½ per cent.

	£.	s.	d.
1/10 ÷	762	16	0
	38	2	9
½ ÷	19	1	4½
Ans.	£57	4	1½ dis.

4.—What is the discount on £765 18s. 4d. at 15 per cent.?

	£.	s.	d.
1/10 ÷	765	11	4
	38	5	11 × 3
Ans.	£114	17	9 dis.

A NEW METHOD FOR COMPUTING COMMISSION,

Brokerage, Premium of Insurance, Interest per Annum, Discount of Invoices or per centage, allowance for ready money, payments at any rate per cent.

RULE.—Multiply the given number of pounds by twice the rate per cent. Take the unit for the pence, and the remaining figures are the shillings.

EXAMPLES.

5.—What is the commission on £83 at 2 per cent.?

£83
4

Ans. s33,2d. as per rule.

6.—What is the commission on £58 at 6¼d. per cent.?

£58
12½

696
29

Ans. 72,5 + 1 = 6 or 72s. 6d.

7.—What is the commission on £125 at 3¾ per cent.?

£125
6¾

750
93

84,3
1

Ans. 84s. 4d. or £4 4s. 4d.

NOTE.—When the unit is more than 4, and when the shillings produced by the multiplication are more than 5, then add one penny to the result for each unit and fraction.

EXERCISE XIV.

ARREARS AND ANNUITIES AT SIMPLE INTEREST.

PROBLEM 1.

The annuity, rate per cent., and time given, to find the amount.

RULE.—Multiply the rent, or annuity, by the time; reserve the product; then multiply the rate by the time, less one, and with half the product, take parts of the reserved product; add such part or parts to the reserved product, and the result is the amount.

EXAMPLES.

1.—If the yearly rent of £45 remain unpaid for five years, at 5 per cent. per annum, what will it amount to?

£.
45
5

$4\times5=20=10=\frac{1}{10}\div$ 225
22 10

£247 10 Ans.

2.—What will an annuity of £120 amount to, suppose it to be forborne for six years, at 5 per cent. per annum?

£.
120×6

$5\times5=25=£12\frac{1}{2}=\frac{1}{8}\div$ 720
90

£810 Ans.

3.—What will a pension of £250 amount to, suppose it remain unpaid for eleven years, at 4 per cent. per annum?

£.
250×11

$10\times4=40=20=\frac{1}{5}\div$ 2750
550

£3300 Ans.

4.—What will a pension of £75 amount to, if it be forborne for twenty-one years, at 2 per cent. per annum?

£.
$75\times21=1575$
$20\times2=40=20=\frac{1}{5}\div$ 315

£1890 Ans.

5.—If a yearly pension of £120, payable every half-year, remain unpaid for six years, at 5 per cent. per annum, what will it amount to?

£.
$120\times6=720$
$5\times5=25$

$\frac{1}{2}$ $12\frac{1}{2}$ = $\frac{1}{5}$ 90

Ans. £810

6.—If a yearly pension of £120, payable quarterly, be forborne for six years at 5 per cent. per annum, what will it amount to?

	£.
	120×6=720
5×5=25	
½+12½ = ⅛	90
Ans.	£810

PROBLEM 2.

The amount, rate per cent., and time given, to find the annuity.

RULE.—Divide the amount by the time, reserve the quotient, then multiply the rate per cent. by the time, less one; take half of the product; consider what part of 100 half the product is; add the numerator and denominator of the fractional part of 100, and with their sum take part or parts of the reserved quotient, which part subtract from the reserved quotient, and you have the amount.

EXAMPLES.

7.—If a yearly rent, forborne for five years, at 5 per cent. per annum amounts to £247 10s., how much was the rent?

	£.	s.
	5÷247	10
4×5=20	49	10
½ 10=$\frac{1}{10}$	4	19
Ans.	£44	11

8.—If an annuity amount to £810 in six years, at 5 per cent. per annum, what was the annuity?

	£.		
	6÷810		
5×5=25	135		
½+12½ = ⅛	16	17s.	6d.
Ans.	£118	2s.	6d.

9.—If a yearly pension amounted to £3,800 in eleven years, at 4 per cent. per annum, how much was the pension?

		£.
	11 ÷	3300
4 × 10 = 40		300
¼ ÷ 20	¼	60
	Ans.	£240

10.—If the amount of a yearly salary, payable half-yearly, be £834 7s. 6d. in five years, at 5 per cent. per annum, what is the yearly salary?

	£.	s.	d.
	5 ÷ 834	7	6
5 × 4 = 20	166	17	6
¼ ÷ 10 = $\frac{1}{10}$	16	13	9
Ans.	£150	3	9

*11.—If the amount of an annuity, payable quarterly, was £839 1s. 3d. in five years, at five per cent. per annum, what was the annuity?

	£.	s.	d.
	5 ÷ 839	1	3
5 × 4 = 20	167	16	3
¼ ÷ 10	16	15	7½
Ans.	£151	0	7½

EXERCISE XV.

ANNUITIES, OR FREEHOLD ESTATES.

PROBLEM 1.

The yearly rent and rate per cent. given, to find the purchase money.

RULE.—Multiply the yearly rent by that part which the rate is of 100, and you have the purchase money; or divide the yearly rent by the rate, the quotient multiplied by 100 is the purchase money.

EXAMPLES.

1.—What is the value of a freehold of £550 a year, allowing the buyer 5 per cent. per annum?

£550
20

Ans. £11000

2.—What is the value of an estate of £1200 a year, allowing the purchaser 4 per cent. per annum?

£1200 or 4 ÷ 1200
4 = 25

300
£30000 Ans. 100

£30000

PROBLEM 2.

The purchase money and rate per cent. given, to find the yearly rent.

RULE.—Divide the purchase money by that part which the rate is of 100, and you have the yearly rent.

EXAMPLES.

3.—If an estate be sold for £11,000, what must be the yearly rent to allow the buyer 5 per cent. per annum?

£.
$\frac{1}{20}$ ÷ 11000

£550 Ans.

4.—If a freehold be sold for £30,000, what must be the yearly rent to allow the purchaser 4 per cent. per annum?

£.
$4\frac{1}{25}$ 30,000

Ans. £1200

PROBLEM 3.

The yearly rent and purchase money given, to find the rate per cent.

RULE.—Divide the purchase money by the yearly rent; 100 divided by the quotient will give the rate per cent.

EXAMPLES.

5.—If an estate of £550 be bought for £11,000, at what rate per cent. is the money laid out?

£.
550 ÷ 11000

20 ÷ 100 = 5 per cent. Ans.

6.—If an estate of £1200 a year is bought for £30,000, at what rate per cent. is the money laid out?

£.
1200 ÷ 30,000

25 ÷ 100 = 4 per cent. Ans.

PROBLEM 4.

The yearly rent and rate per cent. given, to find the number of years' purchase.

RULE.—Divide the yearly rent by the rate per cent., the quotient is the number of years' purchase. The number of years' purchase multiplied by 100, is the purchase money.

EXAMPLES.

7.—If the yearly rent of an estate be £550, how many years' purchase must be given in order to lay out the money at 5 per cent.?

5 ÷ 550

110 years' purchase.—Ans.

8.—If the yearly rent of an estate be £1200, how many years' purchase must be given in order to lay out the money at 4 per cent.?

4 ÷ 1200

300 years' purchase.—Ans.

9.—If 110 years' purchase be given for an estate, what was the purchase money?—Ans. 110 × 100 = £11000.

EXERCISE XVI.

PROFIT AND LOSS, NEWLY ARRANGED.

PROBLEM 1.

Given the whole profit and rate per cent., to find the prime cost.

RULE.—Multiply the gain by that part which the given rate is of 100, and you have the prime cost or purchase money.

EXAMPLES.

1.—If by selling goods at 2½ per cent. profit I clear £13, what did the goods cost me?

£13
40

£520 Ans.

2.—If by selling tea at 5 per cent. profit I clear £19 19s., what did the tea cost me?

£19 19s.
20

£399 0 Ans.

3.—If by selling sheep at 12½ per cent. profit I clear £27, how much have I paid for the sheep?—27 × 8 = £216. Ans.

PROBLEM 2.

The whole gain and rate per cent. given, to find the selling price.

RULE.—See what part the rate is of 100; add the numerator of the fraction to its denominator, and by their sum multiply the whole gain, which will give the selling price.

EXAMPLES.

4.—If by selling goods at 12½ per cent. I clear £14, how much did I receive for the goods?—12½ = ⅛; 8 + 1 = 9 × 14 = £126. Ans.

5.—If by selling tobacco at 20 per cent. profit I clear £199, how much have I received for it?—20 = ⅕; 1 + 5 = 6 × 99 = £594. Ans.

6.—If by selling timber at 25 per cent. profit I clear £77, how much have I received for it?—25 = ¼; 1 + 4 = 5 × 77 = £385. Ans.

PROBLEM 3.

Given the whole loss and rate per cent., to find the selling price.

RULE.—Consider what part the rate is of 100; from the denominator of the fraction subtract the numerator, and by their difference multiply the given loss.

EXAMPLES.

7.—If by selling goods at 20 per cent. loss, I lose £25, how much have I received for them?—20 = ⅕; 1 — 5 = 4 × 25 = £100. Ans.

8.—If by selling goods at 25 per cent. loss, I lose £16, how much have I received for it?—25 = ¼; 1 — 4 = 3 × 16 = £48. Ans.

9.—If by selling cotton at 10 per cent. loss, I lose £1234, how much have I received for it?—10 = 1/10; 1—10 = 9 × 1234 = £11,106. Ans.

10.—By selling wool at 33⅓ per cent. loss, I lose £77 how much have I received for it?—33⅓ = ⅓; 1 — 3 = 2 × 77 = £154. Ans.

11.—If I sell timber at 8⅓ per cent. loss, I lose £155, how much have I received for it?—8⅓ = 1/12; 1 — 12 = 11 × 155 = £1705. Ans.

PROBLEM 4.

The first cost and selling price being given, to find the gain per cent.

RULE.—Subtract the first cost from the selling price; divide the first cost by their difference, and 100 divided by the quotient will give the rate per cent. gain.

EXAMPLES.

12.—Bought a yard of broad cloth at 6s., and sold it for 7s.; what was the gain per cent?—7—6=1 in 6—6 in 100=16⅔ per cent. Ans.

13.—If I buy a horse for £15 and sell it for £17 10s., what is the gain per cent.?

£17 10s.
15 0

£2 10s. Ans.

2—10 in 15=6 in 100=16⅔ per cent. Ans.

14.—If I buy tea at 6s. per lb., and sell it at 6s. 8d., what will I gain per cent.?

6s. 8d.
6 0

0s. 8d. Ans.

8d. in 6s.=9 in 100=11⅑ per cent Ans.

15.—Bought linen at 12d. per yard, and sold it at 13½.; what is the gain per cent.?

13½d.
12

1½d. Ans.

1½ in 12=8 in 100=12½ per cent. Ans.

16.—If I buy broad cloth at 13s. 4d. per yard, and sell it at 20s., what do I gain per cent.?

20s.
13 4

6s. 8d. Ans.

6s. 8d. in 13s. 4d.=2 in 100=50 per cent. Ans.

17.—Bought tobacco at 3s. per lb., and sold it at 3s. 4d.; what is the gain per cent.?

3s. 4d.
3 0

0s. 4d. Ans.

4d. in 3s.=9 in 100=11⅑ per cent. Ans.

PROBLEM 5.

Given the first cost and rate per cent., to find the selling price.

RULE.—Divide the prime cost by that part which the rate is of 100; add the quotient to the prime cost, and you have the selling price.

EXAMPLES.

18.—Bought a yard of cloth for 6s.; how must I sell it to gain 16⅔ per cent.?

s.
$\frac{1}{6}$ + 6
1

7s. Ans.

20.—Bought a horse for £14; how must I sell it to gain 14¼ per cent.?

£.
$\frac{1}{7}$ + 14
2

£16 Ans.

19.—Bought a quantity of sugar for £22 13s. 6d.; how must I sell it to gain $9\frac{1}{11}$ per cent.?

£. s. d.
$\frac{1}{11}$ + 22 13 6
2 1 $2\frac{8}{11}$

£24 14 $8\frac{8}{11}$ Ans.

21.—Bought tobacco at 3s. per lb.; how must I sell it per lb. to gain $11\frac{1}{9}$ per cent.?

s. d.
$\frac{1}{9}$ + 3 0
0 4

3s 4d. Ans.

22.—Bought a quantity of cotton for £12345; how must I sell it to gain 5 per cent.?

£.
$\frac{1}{20}$ + 12345
617 5

£12962 5 Ans.

PROBLEM 6.

The prime cost of the whole, with a selling retail price given, to find the profit or loss.

RULE.—Find the selling price of the whole from the retail price. If the selling price be more than the prime cost, you have gained; but if less, you have lost so much.

EXAMPLES.

23.—Bought 20 yards of cloth for £19, and sold it at 18s. 4d. per yard; did I gain or lose?

£. s. d.
19 0 0
18 6 8

£0 13 4 loss.

24.—Bought 40 yards of cloth for £33, and sold it for 17s. per yd.; tell me the gain or loss?

£.
34
33

£1 gain.

25.—Bought 60 lbs. of tea, for £22, which I retailed at 7s. 8d. per lb.; tell me the gain or loss?

£.
23
22
£1 gain.

26.—Bought 140 gallons of gin for £66; I retailed the same at 9s. 6d. per gal.; tell me the gain or loss?

£.	s.
66	10
63	0
£3	10 gain.

27.—Bought 220 gallons of rum for £176; sold it immediately at 16s. per gallon; how much have I gained or lost?

s.	
16	176
11	176
176	neither gain nor loss.

EXERCISE XVII.

THE SLIDING RULE TO THE INVERTED SCALE.

The sliding rule is a kind of logarithmic table, and is so constructed as to obtain the solution of arithmetical questions in either multiplication, division, or extraction of the roots of numbers. It is formed of two pieces of box-wood, each 12 inches in length, joined together by a brass folding joint. In one of the pieces there is a brass slider. The rules are commonly marked with A on the rule, B and C on the slider, and D on the girt or square line. Let the learner observe whatever value is given to the first 1 from the left, the numbers following, viz., 2, 3, 4, 5, &c., will represent twice, thrice, four times, &c., that value. If one is reckoned one or unity, the rest will count 2, 3, 4, &c.; but if the one is reckoned ten, then 2, 3, 4, will count 20, 30, 40. Should the first one be called 100, then 2, 3, 4, &c., will count 200, 300, 400, &c. The value of the one in the middle of the line is always ten times that of the first one; the value of the second 2, is ten times that of the first 2; so that if the value of the first 1 be 10, that of the second 1 will be 100; the first 2 will be 20, and the second 2 will be 200, &c. On the lines A, B, and C, there are 50 small divisions betwixt 1 and 2, 2 and 3, 3 and 4, &c. Now, if the first 1 be reckoned 1 or unity, each of the small divisions between 1 and 2, and 2 and 3, &c., will be $\frac{1}{50}$ or ·02; and if you take the

first 1 to be unity, then the small divisions from the second 1 to 2, 2 to 3, &c., will each be ten times greater than $\frac{1}{100}$, or ·02, each of them will be $\frac{1}{10}\frac{2}{0}$ or $\frac{1}{5}$ or ·2. Again if 1 represents 100, the first 2 will be 200; if the second 1 be 1000, the second 2 will be 2000, and so on. The above being well understood, we shall now proceed to the use of the rule.

PROBLEM 1.

To multiply by the sliding rule.

RULE.—Set one on B to one of the factors on A; next against the factor on B, you have the product on A.

EXAMPLES.

1.—Find the product of 3 by 8?

SOLUTION.—Set 1 on B to 3 on A; then against 8 on B will be found the product 24 on A.

2.—Find the product of 24 by 16?

SOLUTION.—Set one on B against 16 on A, then look on B for 34, and against it on the line A will be found the product 544.

PROBLEM 2.

To divide by the sliding rule.

RULE.—Set the divisor on B to the dividend on A; against 1 on B you have the quotient on A.

EXAMPLES.

3.—Find the quotient of 96 divided by 6?

SOLUTION.—Move the slider till 1 on B stands against 6 on A, then the quotient 16 will be found on B, against the dividend 96 on A.

4.—What is the quotient of 108 divided by 12?

SOLUTION.—Set 12 on B against 1 on A; on the line A will be found the quotient 9 against 108 on B.

PROBLEM 3.

Proportion by the sliding rule.

RULE.—Set the first term on the slider B to the second on A; then on the line A will be found the fourth term, standing against the third term on B.

EXAMPLE.

5.—If 4 lbs. of brass cost 36d., what will 12 lbs. come to?

DIRECTION.—Move the slider so that 4 on B will stand against 12 on A, then against 36 on B will be found the fourth term 108 on A.

PROBLEM 4.

Superficial measure by the sliding rule.

RULE.—Multiply the length by the breadth, the product will be the area.

DIRECTIONS.—Set 12 on B against the breadth in inches on A; on the line A will be found the surface in square feet against the length in feet on the line B.

EXAMPLE.

6.—What is the content of a plank 18 in. broad, and 10 feet 3 in. long?

DIRECTION.—Move the slider so that 12 on B stands against 18 on A, then will 10¼ on B stand against 15¾ on A, which is 15¾ square feet.

PROBLEM 5.

To find the solid content of timber by the sliding rule.

Multiply the length, breadth, and thickness together.

Set the length in feet on C to 12 on D, then on C will be found the content in feet against the square root of the product of the depth and breadth in inches on D.

EXAMPLE.

7.—What is the content of a square log of timber, the length of which is 10 feet, and the side of its square base 15 inches?

Set 10 on C against 12 on D, then will 15 on D stand against the content 15⅝ on C.

PROBLEM 6.

To extract the square root by the sliding rule.

Move the slider so that the middle division on C, which is marked 1, stands against 10 on the line D, then against the given number on C, the square root will be found on D.

NOTE.—If the given number consists of an even number of places of figures, as 2, 4, 6, &c., it is to be found on the left hand part of the line C; but if odd numbers, as 3, 5, 7, &c., it is to be found on the right hand side of C, one being the middle point of the line.

EXAMPLES.

8.—Find the square root of 81.

The number of places are even, being two, therefore the number 81 is sought for on the left hand side of the line C. Set 1 on C against 10 on D, then against 81 on C will be found 9, the square root on D.

9.—What is the square root 144?

Set 1 on C to 10 on D, then against 144 on C will be found the square root 12 on D.

EXERCISE XVIII.

TIMBER TABLE STANDARD MEASURE.

1728 cubical inches	make	1 cubical foot.
144 square inches		1 square foot.
50 feet solid round timber		1 ton.
40 feet solid square timber		1 ton.
1 cubical yard		27 cubical feet.

A load of rough timber = 40 cubic feet; a load of square timber = 50 cubic feet; a ton of shipping = 40 cubic feet; a floor of earth = 324 cubic feet; a cord of wood = 8 feet long, 4 feet broad, and 4 feet deep = 128 cubic feet; a stack of wood = 12 feet long, 3 feet broad, and 3 feet deep = 108 cubic feet; a solid yard of earth = 1 load.

SUPERFICIAL MEASURE IN FEET AND INCHES.

PROBLEM 1.

To find the area or superficial content of a board or plank.

RULE.—Multiply the length by the breadth, the product will be the content. When the board is tapering, add both ends together, and half the sum will be the mean breadth; then multiply the mean breadth by the length, the product will be the superficial content.

EXAMPLES.

1.—In a board 12 feet long and 8½ inches broad, how many square feet?—Ans. 8 feet 6 inches.

2.—What is the content of a plank 14 inches broad and 16 feet 6 inches long?—Ans. 19 feet 3 inches.

3.—In a board 15 feet 6 inches long and 10 inches 6 sec. broad, how many square feet?—Ans. 13 ft. 6 in. 9 sec.

4.—Find the content of a plank 20¾ feet long and 12½ inches broad?—Ans. 21 ft. 7 in. 4 sec. 6th.

5.—In a board 10½ feet long and 8½ broad, how many square feet?—Ans. 7ft. 1 in. 3 sec.

Observe,—If the two ends of a plank or board differ in breadth, add the two breadths, and multiply the length by half the sum.

6.—How many square feet in a board 12 feet 9 inches long, the breadth at one end being 15 in. and at the other 10?—Ans. 13 ft. 8 in. 4 sec. 6th.

PROBLEM 2.

When length, breadth, and depth are given, the length being feet, and the breadth and depth inches.

RULE.—Multiply the breadth by the depth; $\frac{1}{12}$ of the product multiplied by the length will give the measure in feet.

7.—How many square feet are there in a plank 16 feet long, 9 inches broad, and 4 inches thick?—16 × 3 = 48 feet. Ans.

8.—How many square feet are there in a plank 21 feet long, 18 inches broad, and 3½ inches thick?—21 × 5 = 105 feet. Ans.

9.—In 5 planks, each 15 feet long, 8 inches broad, and 3 inches thick, how many feet?—15 × 10 = 150 feet. Ans.

10.—In 12 planks, each 11 feet long, 9 inches broad, and 4 inches thick, how many feet?—132 × 3 = 396 feet. Ans.

11.—How many feet are there in a stone pillar 9½ feet high, 9 inches broad, and 8 inches thick?

	ft.	in.
	9	6
		6
Ans.	57	0

12.—In a partition 15½ feet square how many feet?

8+1250

Ans. 156¼ feet.

SUPERFICIAL MEASURE IN YARDS, FEET, AND INCHES.

PROBLEM 3.

RULE.—If the measure be required in any other name greater than feet, first find it in feet, and then bring them to the denomination required.

EXAMPLE.

13.—What is the content of a piece of ground 6 yards 2 feet 6 inches long, and 4 yards 2 feet broad?

	yds.	ft.	in.	ft.	in.
Length,	6	2	6	= 20	6
Breadth,	4	2	0	= 14	

9+287

31 yds. 8 feet. Ans.

14.—What are the contents of an acre of land 12 yards 1 foot long, 7 yards 2 feet broad?—Ans. 94 yards 5 feet.

15.—What are the contents of a garden 45 yards 2 feet long, 36½ yards broad?—Ans. 1666 yds. 7 ft. 7½ in.

NOTE.—The inches remaining signifies square or cubical inches according to the question.

16.—How many yards in a carpet 7 yards 1 foot 4 inches long, 5 yards *2 feet 3* inches broad?—Ans. 42 yds. 7 ft. 36 in.

17.—What is the measurement of 12 windows, 5 feet 3 inches long, 5 yards 1 foot 7 inches broad?—Ans. 19 yds. 2 ft. 108 in.

18.—What is the contents of a floor 13 yards 2 feet 9 inches long, 5 yards 1 foot 7 inches broad?—Ans. 75 yds. 8 ft. 51 in.

SOLID MEASURE, IN YARDS, FEET, AND INCHES.

PROBLEM 4.

RULE.—Solid measure may be computed like superficial, by duodecimals.

EXAMPLES.

19.—What are the solid contents of a wall 13 feet 6 inches long, 5 feet 8 inches high, and 2 feet 7 inches broad?

	ft.	in.	
Length,	13	6	
Height,	5	8	
	67	6	
	9		
Surface,	76	6	
Breadth,	2	7	
	153		
	44	7	6
Ans.	197	7	6

Or thus:

	ft.	in.		
	13	6		
		5		
in.	67	6		
$4\frac{1}{3}$	4	6		
$4\frac{1}{4}$	4	6		
	76	6		
	153	0		
$6\frac{1}{3}$	38	3		
$1\frac{1}{8}$	6	4	6	
	197	7	6	

20.—What are the contents of a cistern, 9 yards 2 feet long, 6 yards 2 feet broad, and 4 yards 2 feet deep?—Ans. 300 yds. 20 ft.

21.—What are the solid contents of a wall, 74 feet 6 inches long, 2 feet 9 inches broad, and 24 feet 3 inches high?—Ans. 4969 ft. 2 in. 7 pt. 6″.

22.—What are the contents of a rampart, 154 fathoms 2 feet long, 6 fathoms 4 feet broad, and 3 fathoms 5 feet high?—Ans. 3944 fathoms 16 ft.

23.—What are the contents of a box, 5 feet 2 in. long, 3 ft. 5 in. broad, and 2 feet 8 inches and 5 parts deep?—Ans. 47 ft. 8 in. 2″. 11‴. 2⁗.

24.—What is the solid measurement of a bale of goods, 3 feet 2 inches long, 2 feet 7 inches broad, and 11 inches deep?—Ans. $7\frac{1}{8}\frac{3}{8}\frac{1}{4}$ feet.

PROBLEM 5.

To find the solidity of square or four-sided timber.

RULE.—Multiply the mean breadth by the mean thickness, and the result by the length for the solidity. If the tree throughout be equally broad and thick, the breadth and thickness, anywhere taken, will be the mean breadth

and thickness; but if it tapers regularly from one end to the other, the breadth and thickness, taken in the middle, will be the mean breadth and thickness. If the tree does not regularly taper, but in some places is thicker than others, find the content of each part separately.

EXAMPLES.

25.—How many solid feet in a piece of timber, 12 feet long, 3 feet broad, and 2 feet thick?—Ans. 72 feet.

26.—Required the solid content of a tree, 16 feet long and 14 inches the side of the square?—Ans. 21 ft. 9 in. 4 sec.

27.—What is the solid content of a tree, 14 feet long and 10½ inches the side of the square?—Ans. 10 ft. 8 in. 7 sec. 6th.

28.—What is the solid content of another tree, 24 feet 6 inches long and 20 inches the side of the square?—Ans. 68 ft. 8 sec.

29.—If a piece of timber be 18½ feet long, 14 inches broad, and 9 inches deep, what is the solid content?—Ans. 16 ft. 2 in. 3 sec.

30.—What is the solid content of a piece of timber or stone, whose sides are 10 inches by 18, and the length 18 feet?—Ans. 22 ft. 6 in.

31.—What is the solid content of a piece of timber, 15 ft. 3 in. in length, breadth 15 in., and depth 4½ in.?—Ans. 7 ft. 1 in. 9 sec. 4th. 6 fths.

32.—How much timber is there in a tree, 2 feet 6 inches by 1 foot 10 in., and 38¾ feet long?—Ans. 177 ft. 7 in. 3 p.

PROBLEM 6.

To find the solidity of unsquared or round timber.

RULE.—Multiply the square by the square in inches, &c., and that product by the length in feet, &c.; divide that product by 144, and you will have the solid feet: if any should remain, divide by 12 for inches.

EXAMPLE.

33.—Admit a piece 20½ ft. long, by 10¼ in. square (which is a quarter of the line contained round the same); required the solid content in feet.

Inches.
10·25
10·25

10506·25
20·5 length.

144 ÷ 2153(78·12·5

Ans. Feet 14·11 inches.

34.—What is the solid content of a round tree, 25 feet long, and girt in the middle 45 inches?—Ans. 21 ft. 11 in. 8 sec. 9 fths.

35.—How much timber in a round tree, 30 feet long, and the girt 42 in.?—*Ans.* 22 ft. 11 in. 7 sec. 6ths.

PROBLEM 7.

A more accurate way is to multiply the square of one-fifth of the girt by twice the length for the solidity.

36.—If the length of a tree is 24 feet, and the girt 8 feet, what is the content?—Ans. 122·88 feet.

37.—The girts of a tree in five different places are 9·43 ft., 7·92 f., 6·15 ft., 4·74 ft., and 3·16 ft., and the length of 17¼ ft.; what is the solidity?—Ans. 54·424992 feet.

NOTE.—Take care to point off your decimal parts.

·25 is the decimal of ¼.
·50 is the decimal of ½.
·75 is the decimal of ¾ of anything.

PROBLEM 8.

Unequal-sided timber.

RULE.—Multiply breadth and thickness together in inches and half inches, and that product by the length in feet, which, divided by 144, cutting off so many decimal figures as there are in the operation, the content will appear in solid feet; the remainder, divided by 12, gives inches.

EXAMPLE.

38.—A piece of timber 26½ feet long, 18½ inches broad, and 14½ inches thick, how many solid feet?

Inches.	
18·5	broad.
15·5	thick.
2682·5	
26·5	length.
144) 7108·625	

Ans. Feet 49 4 4 twelfths, solid.

PROBLEM 9.

To find the content of triangular timber.

RULE.—Multiply the base by the perpendicular in inches, and half that product by the length in feet: divide the result by 144, it will then give the number of solid feet. Divide the remainder by twelve for the inches.

EXAMPLE.

39.—In a piece of timber, whose sides are triangular—viz., the base 29 inches, perpendicular 17½ inches, and the length 12 feet,—how many solid feet contained?

Inches.
26 base.
17½ perpendicular.

455 product.

227½ half the product.
12 length.

144 ÷ 2730

Ans. Feet 18 11 inches, six-twelfths, solid.

PROBLEM 10.

Mahogany.

RULE.—Multiply breadth by depth in inches, and that product by the length in feet, which last product, divided by 12, gives the superficial inch-feet required.

EXAMPLE.

40.—In a mahogany log, 25½ inches broad, 16 inches thick, and 15½ feet long, how many superficial inch feet?

25½ Inches broad.
16 „ thick.

408
15½ In length.

12 ÷ 6324

Ans. 527 Inch-feet.

41.—In a log, 33 inches broad, 19 inches thick, and 23⅓ feet long, how many superficial feet?

33 Inches broad.
19 „ thick.

627
23⅓

12 ÷ 14630

Ans. 1219⅙ inch-feet.

SPECIFIC GRAVITY.

Specific gravity is the relative weight of any body compared with the weight of another taken as a standard of the same bulk. The standard is water: one cubic foot weighs 1000 ounces avoirdupois, at a temperature of 60 Fahrenheit.

TABLE OF THE GRAVITY OF WOOD, FROM CORK TO LIGNUMVITÆ.

	Specific Gravity.		Specific Gravity.
Cork	246	Maple and Riga Fir	750
Poplar	383	Ash and Dantzic Oak	760
Larch	544	Yew, Dutch	788
Elm and English Fir	556	Apple Tree	793
Mahogany, Honduras	560	Alder	800
Willow	585	Yew, Spanish	807
Cedar	596	Mahogany, Spanish	852
Pitch Pine	560	Oak, American	872
Pear Tree	661	Boxwood, French	912
Walnut	671	Logwood	913
Fir, Forest	694	Oak, English	970
Beech	696	Do., 60 years cut	1170
Cherry Tree	715	Ebony	1331
Teak	745	Lignumvitæ	1333

PROBLEM 11.

To find the magnitude of a body from its weight.

RULE.—Weight of the body in ounces divided by its specific gravity in table = content in cubic feet.

EXAMPLES.

42.—How many cubic feet are there in one ton of mahogany?

1 ton = 20 cwt. = 35840 ounces in a ton.

Look to mahogany, and opposite you will find 560, which divided into the ounces of a ton, will stand thus:—

560 ÷ 35840

64 cubic feet Ans.

Had the timber been fir; look to fir and you will find 556, which divide into the ounces in a ton, thus:—

556 ÷ 35840 ounces.

64·46 cubic feet.

Or English oak:

970 ÷ 35840

Ans. 36·94 cubic feet.

PROBLEM 12.

To find the weight of a body from its bulk.

RULE.—Cubic feet × specific gravity = weight in ounces.

EXAMPLE.

43.—What is the weight of a log of larch, 14 feet long, 2½ broad, and ¼ thick?

$2.5 \times 1.25 \times 14 = 43.750$: then

$43.75 + 544 = 23800$ ounces = 13 cwt. 1 qr. 3 lbs. 8 oz.

PROBLEM 13.

Sawyers' Work, measured with a line.

Measure off your several cuts alternately with a line, which afterwards measure on the rule.

RULE.—Multiply the line by length in feet and inches, and you will have the product required.

EXAMPLE.

44.—Admit 34 feet, 6 inches line, by 9½ feet long.

	ft.	in.	
Line	34	6	
Long	9	6	
	310	6	
	17	3	
Feet of Sawing	327	9	Ans.

EXERCISE XIX.

CARPENTERS' WORK.

Roofing and flooring are measured by the square of ten feet each way, one hundred square feet being one square of work.

RULE.—Multiply the given dimensions together in feet and inches, which product, divided by one hundred (by cutting off the figures to the right), will give the squares required.

EXAMPLES.

45.—A piece of work, 96 feet 3 inches by 21 feet 3 inches: required the number of squares contained therein?

ft. 96·3 inches.
21·3

100 ÷ 20.45.3.9 Ans. 20 squares, 45 feet, 3¾ inches.

46.—A piece of work, 14 feet 6 inches by 10 feet 3 inches: required the square yards contained?

$14\frac{1}{2}$
$10\frac{1}{4}$

$9 + 148\frac{1}{8}$

Ans. $16\frac{3}{9}\frac{7}{2}$ yds.

EXERCISE XX.

CALCULATION OF GLAZIERS' WORK.

The dimensions used are feet, inches, and parts; in some instances, feet, tenths, and hundredths. The work is calculated in square feet.

Windows are sometimes measured by taking the dimensions of one pane, and multiplying its superfices by the number of panes. But generally they take the length and breadth of the whole frame for the glazing. Circular windows are measured as if they were square, taking for their dimensions the greatest length and breadth.

1.—If a pane of glass 3 feet 6 inches and 9 parts long, and 1 foot 3 inches and 3 parts broad, how may feet of glass in that pane?

	3	6	9			3,56
	1	3	3			1,277
	3	6	9			2492
		10	8	3		2492
			10	8	3	712
						356
Ans.	4	6	3	11	3	
						Ans. 4,54612

2.—How many feet of glass are there in 10 panes, each 4 feet 8 inches and 9 parts long, and 1 foot 4 inches and three parts broad?—Ans. 60,403.

3.—How many feet of glass are there in 20 panes, each 3 feet 6 inches and 9 parts long, and 1 foot 3 inches and 3 parts broad?—Ans. 80 ft. 6 in. 6 pts.

4.—If a window be 7 feet 6 inches high and 3 feet 4 inches broad, how many square feet of glass contained in it?—Ans. 25 ft.

5.—How many feet in an elliptical fan light of 14 ft. 6 in. in length, and 4 ft. 9 in. in breadth?—Ans. 68 ft. 10 in.

6.—What will the glazing of a triangular skylight come to at 20d. the foot, the base being 12 ft. 6 in. and the height 6 ft. 9 in.?—Ans. £3 10s. 3½d.

EXERCISE XXI.

CALCULATION OF BRICKLAYERS' WORK.

The chief part whereof is measured by the perch, being twenty-one feet long, nine inches thick, and one foot high.

RULE.—Multiply length by height in feet and inches, and that product by the inches in thickness, which last product divide by nine, and that

quotient by twenty-one, will give the perches sought, standard measure; but when the thickness is nine inches only, multiply the given length and height together, and divide by twenty-one for perches.

7.—A piece of work, 66 feet long, 20 feet 6 inches high, and 28 inches thick, how many perches are contained therein?

ft.	in.	
66	0	length.
20	6	height.
1320		
33		
1353		
28		
9÷37884		
21÷4209	3	
Perches 200		9 ft. 3 in. Ans.

In Rough Stone Work.

Twenty-one feet long, twelve inches high, and eighteen inches thick make a perch.

Multiply in like manner as above directed; that is, length and height together, in feet and inches, and the product multiply by the inches in thickness, which last product divided by 18, and that quotient by 21, gives the perches contained. But when the thickness is 18 inches only, multiply the given length and height together, and divide by 21 for perches.

One thousand of our common bricks (mortar and work) will make four perches and a quarter of work.

Two hundred and thirty-six bricks (mortar and work) will make a perch.

To find the solid content of a marble block.

RULE.—Multiply length by breadth in feet and inches, and that product by the depth in feet and inches will give you the solid content in feet, by which it is sold.

Observe,—Twelve solid feet of marble make a ton.

8.—How many solid feet in a marble block, 6 ft. 6 in. long, 2 ft. 4 in. broad, and 1 ft. 3 in. thick?

6 ft.	6 in.	
2	4	broad.
15	2	
1	3	thick.
18	11.6	Ans.

EXAMPLE.

9.—What is the content of a marble block 6 feet 6 inches long, 2 feet 4 inches broad, and 1 foot 3 inches thick?

	ft.	in.		
	6	6	length.	
	2	4	breadth.	
	13	0		
	2	2	0	
	15	2	0	
	1	3	0	thick.
	15	2	0	
	3	9	6	0
Ans.	18	11	6	0

10.—What is the content of a block 4 feet 3 inches long, 2 feet 6 inches broad, and 2 feet 1 inch 5 parts thick?—Ans. 22 ft. 6 in. 0 pts. 7″. 6‴.

SLATERS' WORK

Is measured by the square of one hundred square feet.

GENERAL OBSERVATIONS.—No deduction for chimney shafts. Hips, valleys, and eves, added to the content of the roof as double measurement.

600	Double slates cover	... ...	1 square.
1000	Single do.	do.	1 square.
165	Tiles ...	do.	1 square.
40	Laths ...	do.	1 square.
1	Ton slates	do.	1½ square.

11.—How many squares in a roof double slating, 68 ft. long, and 19½ from the eve to the pitch of the roof?

68
19½
600 ÷ 1326
Ans. 2¼ nearly.

EXERCISE XXII.

TONNAGE OF SHIPS, BY THE PARLIAMENTARY METHOD.

RULE 1.—Multiply the length of the keel, taken within the vessel, or as much as the ship treads upon the ground, by the length of the midship beam, taken also within, from plank to plank, and that product by half the breadth, taken as the depth; then divide the last product by 94, and the quotient will be the tonnage.

EXAMPLES.

1.—If the length of a ship's keel be 80 feet, and midship beam 30, give the required tonnage?

80
80
2400
15
94 ÷ 36000
88
72
Ans. $382\frac{2}{3}\frac{3}{4}$

2. — If the length of a ship's keel be 87 feet 6 inches, and the midship beam 28 feet 8 inches, find the required tonnage?—Ans. $382\frac{4}{8}\frac{0}{4}\frac{3}{6}$.

RULE 2.—Take the dimensions on the outside of the light mark, as the ship swims, being unladen, to find the content of the empty ship. But if the measure of the ship be taken from the light mark to her full draught of water, when laden, it will give the burden of the ship; then the length, breadth, and depth multiplied together, and the product divided by 100 for men-of-war (which gives an allowance for guns, anchors, &c., that are all burdens, but no tonnage), and by 95 for merchant ships, will give the tonnage.

Observe,—A hundred solid feet make a ton.

3. — Required the tonnage of Noah's Ark, the length being 300 feet, breadth 50, and depth 30?

300
50
15000
30
95 ÷ 450,000
055
736
Ans. $4736\frac{1}{1}\frac{8}{9}$

RULE 3.—The shipwrights of London multiply the length of the keel by the extreme breadth of the ship, taken from out to outside, and that product by half the breadth; and this they divide by 94 for merchants ships, and 100 for men-of-war; the quotient is the tonnage of the respective classes.

4. — What is the tonnage of an 80 gun ship, the length of whose keel is 149 feet 4 inches, and the extreme breadth 49 feet 8 inches?—*Ans.* $1841\frac{9}{1}\frac{3}{4}$.

5.—The given length of keel of a 74 is 138 feet, and the extreme breadth 46 feet 9 inches; what is the tonnage?—Ans. 1508 $\frac{9}{100}$.

A method practised in the Royal Navy.

RULE 4.—Let fall a perpendicular from the foreside of the stern at the height of the hawse hole, and another from the back of the main port at the height of the wing transom; from the distance between these perpendiculars deduct $\frac{1}{3}$ of the extreme breadth, and as many times 2½ inches as there are feet in the height of the wing transom above the upper edge of the keel; the remainder is the length of the keel for tonnage. Multiply the length of the keel by the extreme breadth, and that product by half the breadth; then divide by 94 for the tonnage.

6.—Given the length of the keel 68 feet, and the extreme breadth 22; required the tonnage?—Ans. 175 $\frac{6}{4}$.

7.—What is the tonnage of a ship whose keel is 78 feet, and the extreme breadth 24½?—Ans. 249 $\frac{3}{4}$.

8.—The length of the keel is 70 feet, and the extreme breadth 24; what is the tonnage?—Ans. 214 $\frac{2}{4}$.

FOREIGN WEIGHTS AND MEASURES.

CAPE OF GOOD HOPE.

LIQUID MEASURE.

16 flasks	=	1 anker.
4 ankers	=	1 aam.
4 aams	=	1 leaguer.

CORN.

4 schepels	=	1 muia.
10 muias	=	1 load.

The muia of wheat weighs 196 lbs.
English = 3 imperial bushels.

CLOTH AND LONG MEASURE.

12 Rhyland inches	=	1 Rhyland foot.
27 ditto	=	1 Dutch ell.
144 ditto	=	1 square foot.
164 square feet	=	1 rood.
600 roods	=	1 morgen.

Accounts in £ s. d., or Rix Dollars, Schillings, or Stivers.

1 stiver	=	⅜ of a penny.
6 stivers	=	1 shilling, or 2¼d. sterling.
1 rix dollar	=	18d. sterling.

CHINA—CANTON.

Merchandise weights are the pecul, catty, and tael. The pecul is divided in 100 catties, or 1600 taels.

1 tael weighs avoirdupois	=	1⅓ oz.
16 taels, or 1 catty	=	1⅓ lbs.
100 catties, or 1 pecul	=	133⅓ lbs.

A pecul weighs 162 lbs. 3 dwts. 3 grs. troy. English weights are used in delivering a cargo, and are afterwards changed into catties and peculs.

The weights are the candy of 20 mounds; the mound is divided into 8 vis, 320 pollams, or 3200 pagodaes; the vis is divided into 5 seers. The candy of Madras = 500 lbs. avoirdupois; the pagoda, 2 oz. 3 grs.

The measures of capacity are the garce (or corn measure), containing 80 parahs, or 400 marcals, each marcal 8 puddies, or 64 ollocks. The marcal measures 750 cubic inches, and weighs 27 lbs. 2 oz. 2 drs. of spring water, consequently 45 marcals are equal to 15 Winchester bushels.

Accounts are kept in rupees: 12 fanams = 1 rupee, 80 cash = 1 fanam; and 42 fanams = 1 pagoda. The gold coins are the star, or current pagoda, which = 7s. 5¼d.; the gold rupee, value at the English mint = £1 9s. $2\frac{1}{4}\frac{1}{2}$ d.

GERMANY—BREMEN.

2 loths	=	1 ounce.
8 ounces	=	1 mark.
2 marks	=	1 commercial lb., or 7690 English qrs.
1 centner	=	116 lbs.

DRY MEASURE.

4 pints	=	1 viertel.
4 viertels... ...	=	1 scheffel.
10 scheffels ...	=	1 quart.
4 quarts	=	1 last.

1 last = 10 qrs. 0.7 bushels; a barrel of salt = 3½ scheffels; a last of coals = 2 chaldrons, Newcastle measure.

1 shippound	=	2½ centners, or 290 lbs.
1 wadge of iron	=	120 lbs.
1 stone of flax	=	20 lbs.
1 ditto wool	=	10 lbs.
1 ton of butter	=	300 lbs.

LIQUID MEASURE.

8 quarts	=	1 viertel.
5 viertels	=	1 anker.
4 ankers	=	1 tierce.
1½ tierce	=	1 oxhoft.
1 oxhoft	=	38 English wine gals.

A barrel of whale oil = 6 steckan, or 216 lbs. = 31½ English wine gals. Accounts are kept in rix dollars of 72 grotes; the grote is divided into 5 swares; a Bremen rix dollar = 3s. 2d. sterling; par of exchange £1 sterling = 6 rix dollars, 32 grotes, 4 swares.

HAMBURGH.

WEIGHTS.

1 centner... ...	=	112 pounds.
1 lb....	=	32 ounces.
1 oz.	=	4 drachms.
1 drachm... ...	=	4 pfennings.
1 schiffpund ...	=	2½ centners.

or 20 liespfund of 14 lbs. each, or 280 lbs.

1 pipe of oil = 820 lbs.; a barrel of butter (willow and hoops) 224 lbs.; common hoops, 230 lbs. nett.

GRAIN MEASURE.

1 last ...	=	60 fass.
1 fass ...	=	2 himpten.
1 himpten	=	4 spint.
20 fass ...	=	1 wispol of wheat or rye
30 fass ...	=	1 do. oats or barley.
2 fass ...	=	1 scheffel of wheat,
3 fass ...	=	1 ditto of oats or barley.

1 Hamburgh last = 11 imperial quarters.

LIQUID MEASURE.

1 fuder	=	6 aums.
1 aum ...	=	4 ankers, or 5 emers.
1 anker	=	5 viertels.
1 viertel	=	2 stubchen.
1 stubchen	=	2 kannen.
1 kannen	=	2 œssel quartiers.
1 emier	=	4 viertels.

1½ aums, or 6 ankers, or 30 viertels, each of 8 quartiers, or bottles =1 hogshead.

Accounts are kept in marks of 12 pfennings of two sorts, banco and current — the banco estimated at 1s. 5½d.; the mark current at 1s. 2½d., 1s. 2¼d. sterling.

PRUSSIA—DANTZIC.

32 loths	make	1 ounce.
16 ounces	... ...	1 pound.
16½ pounds	... ...	1 lispound.
20 pounds	... ...	1 small stone.

33 pounds	make	1 large stone.
110 pounds	... ...	1 centner.
3 centners	... ...	1 shippound (330 lbs.)

LIQUID MEASURE.

5 quarts	...	make	...	1 anker.	2 hhds.	... make	... 1 both.
4 ankers	...	...	...	1 ahm.	2 both	... ...	... 1 fuder.
1½ ahm	...	...	...	1 hhd.	2 fuder	... ...	... 1 last.

A pipe=2 ahms; the ahm=39⅔ English gallons.

CORN MEASURE.

The last of 60 scheffels=11 qrs. 3 bushels, and the last of 56½ scheffels=10 qrs. 7 bushels. Oak planks, deals, and pipe staves are sold per shock of 50 pieces. Wheat, rye, &c., of 56½ scheffells. Accounts are kept in thalers or dollars, silver groschen and pfennings.

1 thaler	=	30 silver groschen.
1 groschen	=	12 pfennings.

The thaler is generally estimated at 3s.

TUSCANY—LEGHORN.

The pound is divided into 12 ounces, 96 drachms, 288 denai, and 6912 grani, and equal 5240 English grains. The quintal, or centinajio=150 lbs.; the centaro=150 lbs.; but a centaro of sugar=151 lbs., oil 88 lbs., brandy 120 lbs., stock fish 160 lbs. The rottolo=3 lbs. Corn is sold by the sack or sacco, 4 of which are equal to 1 imperial quarter.

LIQUID MEASURE.

2 mezette=1 boccale; 2 boccali=1 fiasco; 20 fiaschi=1 barile or 12 English wine gallons: the barile of oil is about 66 lbs. avoirdupois, or 16 fiaschi of 2 boccali each.

Long measure is the braccio, divided in 20 solidi, 60 quattrine or 24 denaii. 155 bracci=100 English yards. 1 canna of 4 bracci=12 English inches.

Accounts are kept in lire Toscane: the lire is divided 20 solidi di lire, each of 5 centisimi.

NAPLES.

The weights are the cantaro and rotola. The cantaro gross = 196½ lbs. avoirdupois; the cantaro piccolo 106 lbs. avoirdupois. In corn, 36 tomolo = 1$\frac{2}{5}$ Winchester bushel.

In wine, the carro is 2 botti, 24 barrile or 1440 carraffe. 1 carro = 264 English wine gallons. Pipe of wine or brandy is 132 English gallons. *Oil:*—The salma is divided into 16 staje; 256 quarti, or 1536 misurette; 1 salma = 42¾ English wine gallons. *Long Measure:*—The canna is divided into 8 palmi, or 96 onzie, and = 6 feet 11 inches English. Accounts are kept in ducati di regno of 100 grani. 1 ducat = 10 carlina, or 3s. 5½d. nearly, sterling. The oncetta = 10s. 3½d., the smallest gold piece.

PORTUGAL—LISBON.

WEIGHTS.

8 ounces make a marc, 2 marcs a pound or arratel, 22 pounds 1 arroba, 4 arrobas 1 quintal. For corn and salt the measure is the moyo, divided into 15 fanegas, 30 alquirés, 240 quartos, &c. *Liquids:*—The almude is divided into 2 potes, 12 canadas, or 48 quartelles. 18 almudes = 1 baril; 26 almudes = 1 pipe, and 52 almudes = 1 tonelado, which last = 227½ English wine gallons. A Lisbon pipe of 31 almudes is equal to 140 English gallons.

LENGTH.

3 palmos make a covado or cubit; 1⅔ covados = 1 vara; 2 varas = 1 branco. Accounts are kept in rees, 1000 of which make 1 milrae. The gold piece of 6400 rees = 35s. 11d. sterling, and the gold cuisado = 2s. 3d.

RUSSIA—PETERSBURG.

Gold, Silver, or Merchandise:—3 sotnicks make 1 loth; 32 loths 1 pound; 40 pounds 1 pood; 10 poods 1 berkovitz. The pood = 36 lbs. 10 oz. 11 drs. avoirdupois. *Long Measure:*—16 wershok make 1 arsheen; 8 arsheen = 1 sashen; 50 sashen = 1 verst; 1 sashen = 7 English feet; 1 arsheen = 28 English inches; 100 Russian feet = 114⅓ English feet; 1 verst = 5 furlongs 12 poles.

The chief measure in corn is the chetwert, subdivided into 2 osmins, 4 pajocks, 8 chetwericks, or 64 garnitz.

Accounts are kept in roubles of 100 copecks. The gold and silver coins are, the imperial or 10 rouble pieces = £1 12s.; half imperial = 16s.; silver rouble = 3s. 2¾d.

SPAIN—CADIZ.

As there are such discrepancies in weights and measures in the different provinces, we shall give those of Castile.

The quintal is divided into 4 arrobas, or 100 lbs. of 2 marcs each, 100 castile lbs. = 101½ avoirdupois lbs; 100 baras or yards = 12¾ English yards. In corn measure, there is the cahiz, divided into 12 panegas, or 144 celeminas, or 576 quartillas. 5 panegas = 1 English quarter.

LIQUID MEASURE.

The cantaro or arroba is divided into 2 azumbres and 32 quartillas. There are two sorts of arrobas, the greater and lesser: the former = 4½ English wine gallons, the latter 3¼ do.

1 mazo makes 16 arrobas; 1 botta, 30 arrobas wine, or 39½ oil; 1 pipe, 27 arrobas wine, or 34½ oil; 1 botta = 127½ English gallons, and 1 pipe 114¾ ditto.

Accounts are kept by the real, of which there are 10⅝ in the peso duro, or hard dollar. A real is divided into 16 quintos or 34 maravedis: a dollar = 4s. 4¾d. sterling; a real 4¼d.

FOREIGN COINS,

WITH THEIR RELATIVE VALUE IN BRITISH MONEY.

AMERICA.

			£.	s.	d.
An Eagle	or	10 Dollars	2	3	11½
Half Eagle	„	5 do.	1	1	11¾
Quarter Eagle	„	2½ do.	0	11	0
A Dollar	„	100 Cents	0	4	4
Half a Dollar	„	50 do.	0	2	2
Quarter Dollar	„	25 do.	0	1	1
Cent	„	(not quite)	0	0	0½
Half Cent	„	(do.)	0	0	0¼

BENGAL.

Gold Mohur	or	16 Sica Rupees	2	0	0
Pagoda	„	56 Anas	0	8	9
English Crown	„	2 Rupees	0	5	0
French Ecu	„	2 do.	0	5	0
Rupee	„	16 Anas	0	2	6
Siano	„	10 do.	0	1	6¾
Ana	„	12 Pices	0	0	2
Viz	„	6 do.	0	0	1
Fanam	„	4 do.	0	0	0¾
A Pice	„	...	0	0	0⅓

CHINA.

A Yale	or	10 Maces	0	6	8
Crown	„	2 Rupees	0	4	8
Ecu	„	7 Maces	0	4	8
Rix Dollar	„	70 Candarins	0	4	8
Dollar	„	2 Rupees	0	4	8
Rupee	„	35 Candarins	0	2	4
Mace	„	10 do.	0	0	8
Candareen	„	10 Caxa	0	0	0⅘

DENMARK AND NORWAY.

			£	s.	d.
A Ducat.	or	11 Marcs	0	8	3
Rix Dollar	„	6 do.	0	4	6
Crown	„	4 do.	0	3	0
Rix Art..	„	24 Skillings	0	1	1½
Rix Marc	„	20 do.	0	0	11¼
Marc	„	16 do.	0	0	9
Duegen...	„	9 do.	0	0	5
Skilling...	„	...	0	0	0⅝

FRANCE.

	£	s.	d.		£	s.	d.
A Louis	0	16	8	15 Sous Piece	0	0	7½
6 Livre Piece	0	5	0	6 Sous Piece	0	0	3
5 Franc Piece	0	4	2	Double Sous	0	0	1
3 Livre Piece	0	2	6	6 Liard Piece	0	0	0¾
30 Sous Piece	0	1	3	Sous	0	0	0½
Franc, or 20 Sous	0	0	10	2 Liards	0	0	0¼
Demi-Franc, 10 ditto	0	0	5				

HOLLAND.

	£	s.	d.		£	s.	d.
Ducat, or 105 Stivers	0	9	2¼	Scalin, 6 ditto	0	0	6⅛
Guilder, 60 ditto	0	5	3	Stiver, 2 groats	0	0	1
Rix Dollar, 50 ditto	0	0	4⅛	Groat, 8 Pennings	0	0	0½
Florin, 20 ditto	0	1	9				

PORTUGAL.

	£	s.	d.		£	s.	d.
Joaneza, or 64 Testoons	1	16	0	Crusade of Ex. 4 Testoons	0	2	3
Mœda, 48 ditto	1	7	0	Testoon, 5 Vintins	0	0	6¾
Milree, 10 ditto	0	5	7½	Vintin, 20 Rees	0	0	1⅛
New Crusade, 24 Vintins	0	2	8½				

RUSSIA AND MOSCOVI.

	£	s.	d.		£	s.	d.
Xervoniz, or 2 Rubles	0	9	0	Grievene, 10 ditto	0	0	5⅛
Ruble, 100 Cupecs	0	4	6	Altin, 3 ditto	0	0	1½
Poltin, 50 ditto	0	2	3	Cupec	0	0	0½
Polposin, 25 ditto	0	1	1½				

SPAIN.

	£	s.	d.		£	s.	d.
Pistole or Doubloon, or 32 Reals	0	14	4	Piastre of Ex, or 8 Reals	0	3	7
Ducat of Ex., 375 Marave	0	4	11¼	Pistarine, 2 ditto	0	0	10½
Dollar, 10 Reals	0	4	6	Real, 34 Marave	0	0	5½

BRITISH WEST INDIES.

Jamaica, Barbadoes, Antigua, Grenada, &c.

	£	s.	d.
A Guinea, or 30 Shillings	1	1	0
Pistole, or 24 ditto	0	16	0
A Pound, or 20 ditto	0	14	3
Crown, or 7 ditto	0	5	0
A Dollar, or 75 Pence	0	4	6
A Shilling, or 12 ditto	0	0	8½
A Bit, or 7½ ditto	0	0	5½
A Penny, or 2 Halfpence	0	0	0½

The following gold coins are in circulation at Jamaica, with their legal weight and value.

	dwts.	grs.		£	s.	d.	
Portuguese Joannes	18	12	value	5	10	0	currency.
do. Half Joe	9	6	„	2	15	0	„
do. Quarter Joe ...	4	15	„	1	7	6	„
do. Moidore	6	22	„	2	0	6	„
do. Half do.	3	11	„	1	0	0	„
Spanish Doubloon	17	18	„	5	0	0	„
do. Double Pistole ...	8	16	„	2	10	0	„
do. Pistole	4	8	„	1	5	0	„
do. Half Pistole	0	4	„	0	12	6	„
English Guinea	5	8	„	1	12	6	„
do. Half Guinea	3	16	„	0	16	2	„
do. 7s. Piece	1	19	„	0	10	10	„

If any of the coins are lighter than the above weights, three pence are deducted for every grain of deficiency.

FRENCH WEST INDIES.

Martinique, St. Domingo, Guadaloupe, &c.

	£	s.	d.
A Louis D'or, or 32 Livres	1	0	0
Pistole, „ 26 do.	0	16	9
An Ecu, „ 8 do.	0	4	10½
A Dollar, „ 7 do.	0	4	6
A Livre, „ 20 Sous	0	0	7½
A Scalin, „ 15 do.	0	0	5½
Half Scalin, „ 7½ do.	0	0	2½
A Sous, „ 2 Half Sous	0	0	0½
Half Sous, ...	0	0	0½

In London, the days for negociating foreign Bills of Exchange are Tuesdays and Fridays. Those bought on one post day are paid for on the following post day, at which time second and third Bills of Exchange are received.

The following Table, calculated for the TEN HOURS' BILL, *shows at one view, the amount per Hour, per Quarter Day, per Half Day, per Three-quarter Day, per Day, per Week, per Month, per Three Months, per Half Year, per Year, from Two Shillings to One Pound.*

Week.	Hour.	Quarter Day.	Half Day.	Three Qr. Day.	Day.	Week.	Month.	Three Months	Half Year.	Year.	Total.
s. d.	d.	d.	d.	d.	d.	s. d.	s.	s.	s.	s.	£. s.
2 0	½	1	2	3	4	2 0	8	24	48	96	4 16
2 3	½	1	2½	3½	4½	2 3	9	27	54	108	5 8
2 6	½	1½	2½	3½	5	2 6	10	30	60	120	6 0
2 9	½	1½	2½	4	5½	2 9	11	33	66	132	6 12
3 0	½	1½	3	4½	6	3 0	12	36	72	144	7 4
3 3	½	1½	3½	4½	6½	3 3	13	39	78	166	7 16
3 6	½	1½	3½	5½	7	3 6	14	42	84	168	8 8
3 9	½	1½	3½	5½	7½	3 9	15	45	90	180	9 0
4 0	½	2	4	6	8	4 0	16	48	96	192	9 12
4 3	1	2	4½	6½	8½	4 3	17	51	102	204	10 4
4 6	1	2½	4½	6½	9	4 6	18	54	108	216	10 16
4 9	1	2½	4½	7	9½	4 9	19	57	114	228	11 8
5 0	1	2½	5	7½	10	5 0	20	60	120	240	12 0
5 3	1	2½	5½	7½	10½	5 3	21	63	126	252	12 12
5 6	1	2½	5½	8½	11	5 6	22	66	132	264	13 4
5 9	1	2½	5½	8½	11½	5 9	23	69	138	276	13 16
6 0	1	3	6	9	12	6 0	24	72	144	288	14 8
6 3	1½	3	6½	9½	12½	6 3	25	75	150	300	15 0
6 6	1½	3½	6½	9½	13	6 6	26	78	156	312	15 12
6 9	1½	3½	6½	10½	13½	6 9	27	81	162	324	16 4
7 0	1½	3½	7	10½	14	7 0	28	84	168	336	16 16
7 3	1½	3½	7½	10½	14½	7 3	29	87	174	348	17 8
7 6	1½	3½	7½	11½	15	7 6	30	90	180	360	18 0
7 9	1½	3½	7½	11½	15½	7 9	31	93	186	372	18 12
8 0	1½	4	8	12	16	8 0	32	96	192	384	19 4
8 3	1½	4	8½	12½	16½	8 3	33	99	198	396	19 16
8 6	1½	4½	8½	12½	17	8 6	34	102	204	408	20 8
8 9	1½	4½	8½	13½	17½	8 9	35	105	210	420	21 0
9 0	1½	4½	9	13½	18	9 0	36	108	216	432	21 12
9 3	1½	4½	9½	14	18½	9 3	37	111	222	444	22 4
9 6	1½	4½	9½	14½	19	9 6	38	114	228	456	22 16
9 9	1½	4½	9½	14½	19½	9 9	39	117	234	468	23 8
10 0	2	5	10	15	20	10 0	40	120	240	480	24 0
10 6	2	5½	10½	15½	21	10 6	42	126	252	504	25 4
11 0	2½	5½	11	16½	22	11 0	44	132	264	528	26 8
11 6	2½	5½	11½	17½	23	11 6	46	138	276	552	27 12
12 0	2½	6	12	18	24	12 0	48	144	288	576	28 16
12 6	2½	6½	12½	18½	25	12 6	50	150	300	600	30 0
13 0	2½	6½	13	19½	26	13 0	52	156	312	624	31 4
13 6	2½	6½	13½	20½	27	13 6	54	162	324	648	32 8
14 0	2½	7	14	21	28	14 0	56	168	336	672	33 12
14 6	2½	7½	14½	21½	29	14 6	58	174	348	696	34 16
15 0	3	7½	15	22½	30	15 0	60	180	360	720	36 0
15 6	3	7½	15½	23½	31	15 6	62	186	372	744	37 4
16 0	3	8	16	24	32	16 0	64	192	384	768	38 8
16 6	3½	8½	16½	24½	33	16 6	66	198	396	792	39 12
17 0	3½	8½	17	25½	34	17 0	68	204	408	816	40 16
17 6	3½	8½	17½	26½	35	17 6	70	210	420	840	42 0
18 0	3½	9	18	27	36	18 0	72	216	432	864	43 4
18 6	3½	9½	18½	27½	37	18 6	74	222	444	888	44 8
19 0	3½	9½	19	28½	38	19 0	76	228	456	912	45 12
19 6	3½	9½	19½	29½	39	19 6	78	234	468	936	46 16
20 0	4	10	20	30	40	20 0	80	240	480	960	48 0

The following Table, calculated for the ELEVEN HOURS' BILL, *shows at one view, the amount per Hour, per Quarter Day, per Half Day, per Three-quarter Day, per Day, per Week, per Month, per Three Months, per Half Year, per Year, from Two Shillings to One Pound.*

Week.	Hour.	Quarter Day.	Half Day.	Three Qr. Day.	Day.	Week.	Month.	Three Month	Half Year	Year.	Total.
s. d.	d.	d.	d.	d.	d.	s. d.	s.	s.	s.	s.	£. s.
2 0	¼	1	2	3	4	2 0	8	24	48	96	4 16
2 3	¼	1	2¼	3¼	4½	2 3	9	27	54	108	5 8
2 6	¼	1¼	2½	3¾	5	2 6	10	30	60	120	6 0
2 9	⅜	1¼	2¾	4¼	5½	2 9	11	33	66	132	6 12
3 0	⅜	1½	3	4½	6	3 0	12	36	72	144	7 4
3 3	⅜	1½	3¼	5	6½	3 3	13	39	78	156	7 16
3 6	½	1¾	3½	5¼	7	3 6	14	42	84	168	8 8
3 9	½	1¾	3¾	5¾	7½	3 9	15	45	90	180	9 0
4 0	½	2	4	6	8	4 0	16	48	96	192	9 12
4 3	½	2¼	4¼	6¼	8½	4 3	17	51	102	204	10 4
4 6	½	2¼	4½	6¾	9	4 6	18	54	108	216	10 16
4 9	½	2¼	4¾	7¼	9½	4 9	19	57	114	228	11 8
5 3	⅝	2½	5	7½	10	5 0	20	60	120	240	12 0
5 6	⅝	2¾	5¼	7¾	10½	5 3	21	63	126	252	12 12
5 7	1	2¾	5¼	8¼	11	5 6	22	66	132	264	13 4
5 9	1	2¾	5¾	8¾	11½	5 9	23	69	138	276	13 16
6 0	1	3	6	9	12	6 0	24	72	144	288	14 8
6 3	1	3	6¼	9¼	12½	6 3	25	75	150	300	15 0
6 6	1	3¼	6½	9¾	13	6 6	26	78	156	312	15 12
6 9	1¼	3¼	6¾	10¼	13½	6 9	27	81	162	324	16 4
7 0	1¼	3½	7	10½	14	7 0	28	84	168	336	16 16
7 3	1¼	3¾	7¼	10¾	14½	7 3	29	87	174	348	17 8
7 6	1¼	3¾	7¼	11¼	15	7 6	30	90	180	360	18 0
7 9	1¼	3¾	7¾	11½	15½	7 9	31	93	186	372	18 12
8 0	1⅓	4	8	12	16	8 0	32	96	192	384	19 4
8 3	1⅓	4	8¼	12¼	16½	8 3	33	99	198	386	19 16
8 6	1⅓	4¼	8½	12¾	17	8 6	34	102	204	408	20 8
8 9	1⅓	4¼	8¾	13¼	17½	8 9	35	105	210	420	21 0
9 0	1½	4½	9	13½	18	9 0	36	108	216	432	21 12
9 3	1⅔	4¾	9¼	14	18½	9 3	37	111	222	444	22 4
9 6	1⅔	4¾	9¼	14¼	19	9 6	38	114	228	456	22 16
9 9	1⅔	4¾	9¾	14¾	19½	9 9	39	117	234	468	23 8
10 0	1¾	5	10	15	20	10 0	40	120	240	480	24 0
10 6	1¾	5¼	10½	15¾	21	10 6	42	126	252	504	25 4
11 0	2	5½	11	16½	22	11 0	44	132	264	528	26 8
11 6	2	5¾	11½	17¼	23	11 6	46	138	276	552	27 12
12 0	2	6	12	18	24	12 0	48	144	288	576	28 16
12 6	2¼	6¼	12½	18¾	25	12 6	50	150	300	600	30 0
13 0	2¼	6½	13	19½	26	13 0	52	156	312	624	31 4
13 6	2¼	6¾	13½	20¼	27	13 6	54	162	324	648	32 8
14 0	2⅓	7	14	21	28	14 0	56	168	336	672	33 12
14 6	2⅓	7¼	14½	21¾	29	14 6	58	174	348	696	34 16
15 0	2½	7½	15	22½	30	15 0	60	180	360	720	36 0
15 6	2⅔	7¾	15½	23¼	31	15 6	62	186	372	744	37 4
16 0	2¾	8	16	24	32	16 0	64	192	384	768	38 6
16 6	3	8¼	16½	24¾	33	16 6	66	198	396	792	39 12
17 0	3	8½	17	25½	34	17 0	68	204	408	816	40 16
17 6	3	8¾	17½	26¼	35	17 6	70	210	420	840	42 0
18 0	3¼	9	18	27	36	18 0	72	216	432	864	43 4
18 6	3¼	9¼	18½	27¾	37	18 6	74	222	444	888	44 8
19 0	3⅓	9½	19	28½	38	19 0	76	228	456	912	45 12
19 6	3⅓	9¾	19½	29¼	39	19 6	78	234	468	936	46 16
20 0	3½	10	20	30	40	20 0	80	240	480	960	48 0

There are 311 working days in a year, omitting Christmas Day and Good Friday.

EVERY SPIRIT MERCHANT HIS OWN GAUGER.

THE following table will show, at one view, the quantity of liquor in casks or puncheons, to the tenth of a gallon, from 10 to 130 gallons, which can be ascertained by dipping with a common inch rule into either kegs or puncheons, when lying on the side or standing on the end.

Observe,—If the cask be lying on the side, dip the rule into the bung-hole; count the wet inches; look to the table for the number required, and opposite, in the next column, you will find the number of gallons and tenths. The third column shows the contents if the cask be standing.

CONTENTS, TEN GALLONS.

12-*inch Bung.*

Inch	Gal. 10ths.	Altitude
1	0.4	0.7
2	0.9	1.4
3	1.6	2.2
4	2.6	2.9
5	3.5	3.6
6	5.0	4.4
7	5.5	5.0
8	6.4	5.8
9	7.4	6.6
10	8.3	7.3
11	9.6	8.0
12	10.0	8.8

TWENTY GALLONS.

17-*inch Bung.*

Inch	Gal. 10ths.	Altitude
1	0.3	0.7
2	1.2	1.3
3	2.0	2.5
4	3.2	3.6
5	4.5	4.5
6	6.0	5.5
7	7.5	6.6
8	9.1	7.6
9	10.6	8.7
10	12.3	10.0
11	14.0	11.1
12	15.5	12.2

FIFTEEN GALLONS.

14-*inch Bung.*

Inch	Gal. 10ths.	Altitude
1	0.4	0.7
2	1.2	1.3
3	2.0	2.1
4	3.2	3.0
5	4.5	3.7
6	6.0	4.6
7	7.5	5.5
8	9.0	6.4
9	10.0	7.5
10	11.8	8.4
11	12.9	9.3
12	13.8	10.2

TWENTY-ONE GALLONS.

18-*inch Bung.*

Inch	Gal. 10ths.	Altitude
1	0.5	0.7
2	1.9	1.2
3	2.7	2.0
4	3.9	3.0
5	4.6	4.0
6	6.0	5.1
7	7.0	6.2
8	8.8	7.3
9	10.5	8.4
10	12.0	9.5
11	13.4	10.5
12	14.6	11.5

THIRTY-THREE GALLONS.

21-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.6	1.0
2	1.7	2.0
3	3.1	3.1
4	4.3	4.3
5	6.0	5.5
6	7.9	6.7
7	9.4	8.0
8	11.5	9.4
9	13.5	11.0
10	15.6	12.5
11	17.3	14.0
12	19.5	15.6

THIRTY-SIX GALLONS.

22-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.6	1.1
2	1.6	2.3
3	3.0	3.5
4	4.4	4.7
5	6.2	6.1
6	7.8	7.5
7	9.9	8.9
8	11.6	10.4
9	13.8	11.9
10	15.7	13.5
11	18.0	15.2
12	20.3	17.0

FORTY-TWO GALLONS.

24-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.5	1.2
2	1.5	2.4
3	3.2	3.8
4	4.7	5.2
5	6.4	6.7
6	8.2	8.2
7	10.1	9.8
8	12.0	11.5
9	14.1	13.2
10	16.5	15.1
11	18.8	17.0
12	21.0	19.0

FORTY-FOUR GALLONS.

24-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.5	1.1
2	1.9	2.3
3	3.3	3.6
4	4.9	5.0
5	6.7	6.5
6	8.6	8.1
7	10.5	9.8
8	12.6	11.5
9	14.8	13.5
10	16.9	15.4
11	19.2	17.5
12	22.0	19.6

FIFTY-FOUR GALLONS.

26-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.8	1.3
2	1.9	2.7
3	3.0	4.3
4	4.6	5.7
5	6.3	7.4
6	8.2	9.8
7	10.4	11.0
8	13.0	12.6
9	15.5	14.5
10	18.3	16.4
11	21.2	18.3
12	24.1	20.7

SIXTY GALLONS.

26-inch Bung.

Inch.	Gal. 10ths.	Altitude.
1	0.8	1.4
2	2.2	3.0
3	4.0	4.5
4	5.6	6.2
5	7.9	7.9
6	10.4	9.7
7	13.1	11.5
8	15.8	13.4
9	18.7	15.4
10	20.9	17.4
11	23.9	19.5
12	26.9	21.7

SIXTY-THREE GALLONS.

26-inch Bung.

Inch	Gal. 10ths	Altitude
1	0.8	1.5
2	2.3	3.1
3	4.2	4.8
4	5.9	6.6
5	8.3	8.4
6	10.9	10.2
7	13.7	12.2
8	16.6	14.2
9	19.6	16.2
10	21.9	18.4
11	25.1	20.6
12	28.2	22.9

SIXTY-EIGHT GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	0.9	1.7
2	2.0	3.4
3	4.0	5.3
4	6.3	7.2
5	8.6	9.2
6	11.0	11.2
7	14.0	13.3
8	17.1	15.5
9	19.5	17.7
10	22.8	20.1
11	26.2	22.4
12	28.8	24.9

SIXTY-FIVE GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	0.8	1.5
2	2.0	3.1
3	3.8	4.8
4	6.1	6.6
5	8.6	8.5
6	10.6	10.3
7	13.4	12.3
8	16.3	14.3
9	18.7	16.5
10	21.8	18.7
11	24.6	21.0
12	27.6	23.5

SEVENTY GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	0.9	1.6
2	2.1	3.4
3	4.1	5.2
4	6.5	7.1
5	9.2	9.0
6	11.4	11.0
7	14.4	13.1
8	17.6	15.2
9	20.1	17.4
10	23.3	19.7
11	26.6	22.1
12	29.2	24.5

SIXTY-SIX GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	0.8	1.6
2	2.0	3.3
3	3.9	5.1
4	6.2	6.9
5	8.7	8.8
6	10.7	10.8
7	13.6	12.9
8	16.0	15.0
9	19.0	17.1
10	22.0	19.4
11	25.0	21.7
12	28.0	24.1

SEVENTY-FOUR GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.0	2.1
2	2.6	4.8
3	4.5	7.2
4	7.0	9.9
5	9.9	12.3
6	12.4	14.5
7	15.5	17.0
8	18.6	19.3
9	21.6	22.7
10	25.2	24.6
11	29.0	26.4
12	32.4	29.0

EIGHTY GALLONS.

27-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.0	2.0
2	3.0	4.0
3	5.0	7.0
4	7.0	9.0
5	10.0	11.0
6	13.0	13.0
7	16.6	16.0
8	20.1	18.0
9	23.6	20.0
10	27.0	22.0
11	30.8	24.0
12	34.0	27.6

ONE HUNDRED GALLONS.

30-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.8	3.2
2	3.0	6.5
3	5.2	9.7
4	7.6	12.9
5	10.4	16.2
6	14.4	19.4
7	17.2	22.7
8	21.9	25.9
9	25.4	29.2
10	28.7	32.4
11	32.9	35.7
12	37.3	38.9

ONE HUNDRED AND TEN GALLONS.

32-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.8	2.7
2	3.4	5.4
3	5.4	8.1
4	7.7	11.6
5	10.6	14.2
6	14.6	17.4
7	18.8	21.0
8	22.7	24.2
9	26.6	27.6
10	30.6	31.0
11	34.0	34.5
12	38.0	38.4

ONE HUNDRED AND FIFTEEN GALS.

32-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.8	2.8
2	3.4	5.9
3	5.4	9.0
4	8.0	12.0
5	11.6	15.6
6	14.9	19.8
7	18.6	23.9
8	22.0	27.9
9	25.6	30.6
10	29.0	34.0
11	33.6	37.9
12	38.6	40.9

ONE HUNDRED AND TWENTY GALS.

32-inch Bung.

Inch	Gal. 10ths.	Altitude
1	1.6	2.6
2	3.4	5.4
3	5.4	8.2
4	7.6	11.4
5	10.0	14.4
6	13.6	18.0
7	16.7	21.5
8	20.9	24.0
9	25.0	27.5
10	29.5	31.0
11	34.5	34.5
12	39.9	38.5

ONE HUNDRED AND TWENTY-THREE GALLONS.—32-*inch Bung.*

Inch	Gal. 10ths.	Altitude
1	1.7	2.5
2	3.4	5.2
3	5.6	8.0
4	8.3	10.9
5	12.0	13.8
6	16.0	16.8
7	20.0	20.0
8	24.0	23.2
9	28.1	26.5
10	32.4	30.1
11	36.2	33.6
12	40.3	37.1

ONE HUNDRED AND TWENTY-FIVE GALLONS.—32-*inch* Bung.

Inch	Gal. 10ths.	Altitude
1	1.7	3.6
2	3.4	7.2
3	5.6	10.4
4	8.5	14.6
5	12.0	17.7
6	16.0	20.5
7	20.0	24.0
8	24.0	27.8
9	28.0	30.2
10	32.6	34.0
11	37.0	38.0
12	42.0	41.6

ONE HUNDRED AND THIRTY GALS. 32-*inch* Bung.

Inch	Gal. 10ths.	Altitude
1	1.8	2.6
2	3.6	5.4
3	5.7	8.4
4	8.0	11.4
5	11.6	14.5
6	15.3	17.7
7	19.0	21.2
8	23.0	24.5
9	28.2	28.0
10	33.5	31.4
11	37.5	35.0
12	42.5	38.5

ONE HUNDRED AND THIRTY GALLONS.

32-*inch* Bung.

Inch	Gal. 10ths.	Altitude
13	48.0	42.2
14	53.2	46.0
15	58.5	49.6
16	64.2	53.4
17	71.5	57.2
18	76.8	61.1
19	82.0	65.0
20	87.5	68.7
21	92.6	72.6
22	97.5	76.4
23	102.8	80.2
24	106.7	84.0

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